TUGAS AKHIR – RC14-1501

PERANCANGAN KESESUAIAN KELANDAIAN HOLDING POSITION DAN EXIT TAXIWAY TERHADAP KEMUNGKINAN TERJADINYA SLIDING DAN BERTAMBAHNYA KONSUMSI BAHAN BAKAR PESAWAT

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FINAL PROJECT – RC14-1501

DESIGNING THE ADJUSTMENT OF HOLDING POSITION AND EXIT TAXIWAY TO THE POSSIBILITY OF SLIDING AND ADDITIONAL AIRCRAFT FUEL CONSUMPTION LEVEL

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2018

LEMBAR PENGESAHAN

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TUGAS AKHIR

Diajukan Untuk Memenuhi Salah Satu Syarat
Memeperoleh Gelar Sarjana Teknik
pada
Program Studi S-1 Reguler Departemen Teknik Sipil
Fakultas Teknik Sipil, Lingkungan, dan Kebumian
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SURABAYA, JULI 2018

PERANCANGAN KESESUAIAN KELANDAIAN HOLDING POSITION DAN EXIT TAXIWAY TERHADAP KEMUNGKINAN TERJADINYA SLIDING DAN BERTAMBAHNYA KONSUMSI BAHAN BAKAR PESAWAT

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Abstrak

Salah satu hal yang menjadi fokus dalam perencanaan suatu bandara adalah perencanaan fasilitas sisi udara. Sering kali dalam perencanaan fasilitas sisi udara dijumpai masalah sulitnya dilakukan perencanaan akibat adanya kondisi topografi yang mempengaruhi perencanaan fasilitas sisi udara. Kemungkinan yang ada adalah adanya perbedaan tinggi antara apron dan runway. Aturan kemiringan secara longitudinal sudah diatur pada dokumen ICAO maupun FAA, akan tetapi untuk perbedaan tinggi antara apron dan runway belum ditetapkan, artinya akan ada kemiringan pada exit taxiway dan holding position. Kondisi ini mengharuskan dilakukan rekayasa pada bagian taxiway dengan tetap mempertimbangkan tingkat keselamatan. Untuk itu dibutuhkanlah perancangan kemiringan Holding taxiway agar posisi pesawat yang sedang Holding sebelum memasuki Runway tidak tergelincir dan memasuki Runway.

Di sisi lain perlu dipertimbangkan nilai avtur yang harus bertambah apabila pesawat keluar runway menuju apron karena ada perubahan elevasi. Perancangan kemiringan exit taxiway ini dilakukan dengan menganalisa distribusi beban pesawat ke roda yang kemudian disimulasikan dalam suatu bidang miring dengan persentase kemiringan tertentu hingga didapatkan kemiringan yang paling sesuai. Diasumsikan kekesatan permukaan perkerasan adalah mengikuti perkerasan baru. Simulasi yang dilakukan adalah terhadap semua tipe pesawat. Diharapkan diperoleh kemiringan yang aman dan penggunaan bahan bakar yang minimal untuk beda tinggi per satuan meter.

Dari hasil analisa, diperoleh kemiringan Holding Position yang paling kritis adalah 18°. Dengan kata lain, apabila desain kemiringan akibat perbedaan tinggi antara apron dan runway sama dengan atau dibawah 18° maka aman terhadap sliding. Maka untuk perancangan gradien holding position dapat mengikuti peraturan gradien memanjang taxiway. Untuk kemiringan 2 derajat, semua tipe pesawat sudah mampu mencapai batas kecepatan pesawat dalam keadaan taxiing yaitu 10-20 knot. Untuk itu dalam perancangan exit taxiway, gradien maximum yang dapat digunakan agar semua pesawat dapat berjalan adalah 2 derajat. Dalam perancangan exit taxiway, gradien sangat berpengaruh besar terhadap biaya operasional akibat dari pertambahan konsumsi bahan bakar dari pesawat. Misalnya saja untuk gradien 2° pesawat Boeing 737-900ER, pertambahan biaya operasional pesawat dapat mencapai angka Rp 197.548,- untuk melewati exit taxiway. Sedangkan untuk pesawat besar seperti Boeing 747-8 pertambahan biaya operasional mencapai angka Rp 736.709,-.

***Kata Kunci** : Holding, Exit Taxiway, beda tinggi, konsumsi bahan bakar*

DESIGNING THE ADJUSTMENT OF HOLDING POSITION AND EXIT TAXIWAY TO THE POSSIBILITY OF SLIDING AND ADDITIONAL AIRCRAFT FUEL CONSUMPTION LEVEL

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Abstract

One of the things that became the focus in planning an airport was the planning of air side facilities. Often in air side facility planning it is difficult to do planning due to topography conditions that affect air side facility planning. The possibility exists that there is a high difference between apron and runway. Longitudinal slope rules are set in both ICAO and FAA documents, but for the height difference between apron and runway has not been established, it means there will be a slope on the exit taxiway and holding position. This condition requires engineering on the taxiway section while maintaining safety levels. Therefore it is necessary to design the slope of Holding taxiway so that the position of the aircraft being Holding before entering Runway does not slip and enter Runway.

On the other hand it is necessary to consider the aviation value that must increase if the plane runs out of the runway towards the apron due to an elevation change. The design of the exit taxiway slope is done by analyzing the distribution of aircraft loads to the wheels which are then simulated in a sloping plane with a certain percentage of slope to obtain the most appropriate slope. It is assumed that the pavement surface agitation is following a new pavement. The simulation is carried out on all types of aircraft. It is expected to obtain a safe slope and minimum fuel usage for a height difference on meter unit.

From the analysis results, the most critical holding position of the Holding Position to be used is 18 °. In other words, if the slope design due to the high difference between apron and runway is equal to or below 18 ° then it is safe against sliding. So, for holding position gradient design can follow the regulation of gradient lengthwise taxiway. For a 2° slope, all types of aircraft have been able to reach the aircraft speed limit in the taxiing state of 10-20 knots. For that in the design of exit taxiways, the maximum gradient can be used for all aircraft can run is 2°. In the exit taxiway design, the gradient is very influential to the operational cost cause increases air fuel consumption of the aircraft. For example, for a 2° gradient Boeing 737-900ER aircraft, the increase of aircraft operating costs can reach Rp 197,548, - to pass the exit taxiway. And for large aircraft such as Boeing 747-8 increases operational cost reaches Rp 736,709, -.

***Keywords** : Holding, Exit Taxiway, difference height, fuel Consumption*

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Surabaya, 20 Juli 2018

Penulis

DAFTAR ISI

DAFTAR GAMBAR

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DAFTAR TABEL

BAB I
PENDAHULUAN

1.1 Latar Belakang

Transportasi adalah salah satu sektor vital yang wajib diperhatikan oleh sebuah daerah, sarana dan prasarana transportasi yang memadai akan memberi dampak baik atau buruknya roda perekonomian dalam suatu wilayah tersebut. Seiring perkembangan zaman sarana transportasi semakin dikembangkan, yang disesuaikan dengan kebutuhan dasar dari sistem transportasi dan peruntukkan sistem transportasi tersebut. Meninjau dari segi kecepatan, moda atau sarana transportasi semakin dikembangkan dengan kecepatan tinggi untuk memperkecil jarak dan kesenjangan yang ada. Selain itu sarana transportasi juga semakin dikembangkan dengan tingkat pelayanan yang tinggi dan kepraktisan dalam penggunaannya. Untuk itu sarana transportasi terkini memiliki teknologi yang canggih sehingga dapat melaju dengan kecepatan yang tinggi namun memiliki tingkat kenyamanan yang cukup serta berkapasitas yang besar.

Disamping kemajuan sarana transportasi, juga terjadi kemajuan dalam pengembangan dari lingkup prasarana transportasi itu sendiri yaitu semakin berkembangnya sistem jalan raya, jembatan, jalan tol, pelabuhan serta bandar udara. Baik sarana dan prasarana harus bersama-sama berkembang seiring dengan perkembangan teknologi dan kebutuhan mobilitas penduduk serta tuntutan dinamika pembangunan yang semakin meningkat. Sarana dan prasarana transportasi adalah unsur penunjang berkembangnya kegiatan pada berbagai sektor dan sebagai faktor pembentuk pertumbuhan ekonomi dalam suatu daerah.

Salah satu sub sektor transportasi yang harus diperhatikan adalah sarana dan prasarana transportasi udara. Transportasi udara sebagai salah satu sub sektor yang terbilang muda menunjukkan perkembangan yang sangat pesat dengan teknologi-teknologi yang semakin canggih. Kemajuan teknologi penerbangan ini membuat jarak yang jauh terasa dekat karena waktu tempuh yang sangat cepat. Kemajuan transportasi penerbangan ini, telah mampu merubah sistem perekonomian, peta perkembangan daerah, tingkat mobilitas penduduk dan pembangunan secara luas.

Transportasi udara erat kaitannya dengan kegiatan lalu lintas pesawat udara dan penumpang udara melalui suatu bandar udara (*airport*). Bandar udara adalah simpul penerbangn yang melayani kegiatan lalu lintas penumpang udara dan pesawat udara. Transportasi udara atau penerbangan dapat diartikan jasa pelayanan transportasi udara yang melibatkan moda transportasi udara (pesawat terbang), ruang lalu lintas udara (rute penerbangan), muatan udara (penumpang udara dan kargo udara) serta terminal (bandar udara) yang terdiri dari fasilitas sisi udara dan fasilitas sisi darat (Adisasmita, 2012).

Selain itu, dalam penyelenggaraan dibutuhkan pula unsur instansi atau lembaga terkait kegiatan penerbangan dimana pihak maskapai penerbangan sebagai operator pesawat udara, Angkasa Pura sebagai pihak pengelola bandar udara, dan pemerintah sebagai pihak regulator.

Mengikuti perkembangan yang ada, transportasi melalui udara adalah transportasi yang memiliki tingkat permintaan yang tak sedikit bahkan banyak bandar udara yang sudah tidak mampu menampung kapasitas permintaan yang ada. Untuk itu dibutuhkanlah ekspansi terhadap fasilitas bandar udara sehingga kapasitas yang sudah melebihi tersebut dapat ditampung dan dilayanai oleh suatu bandar udara. Dari data yang dihimpun oleh PT. Angkasa Pura 1 (Persero), pergerakan penumpang di bandara yang dikelola kebanyakan mengalami peningkatan tiap tahunnya, dan hal tersebut tidak diimbangi oleh pergerakan pesawat dan fasilitas penunjang yang ada baik fasilitas sisi udara maupun

fasilitas sisi darat, hal tersebut dapat terlihat dari Tabel 1.1 dan Tabel 1.2 yang diperoleh dari Annual Report PT. Angkasa Pura I (Persero).

Tabel 1. 1 Pergerakan Pesawat Bandar Udara Indonesia

Bandara / Airport	Satuan / Unit	2015	*2014*	Kenaikan (Penurunan) / *Increase / (Decrease)*	% Perbandingan Terhadap 2014 / *Compared to*
I Gusti Ngurah Rai	Pesawat / *Aircraft*	126.337	*130.149*	*(3.812)*	*-2,93%*
Juanda	Pesawat / *Aircraft*	137.051	*136.195*	*856*	*0,63%*
Sultan Hasanuddin	Pesawat / *Aircraft*	88.592	*83.551*	*5.041*	*6,03%*
S.A.M.S Sepinggan	Pesawat / *Aircraft*	70.835	*68.470*	*2.365*	*3,45%*
Frans Kasiepo	Pesawat / *Aircraft*	8.597	*10.029*	*(1.432)*	*-14,28%*
Sam Ratulangi	Pesawat / *Aircraft*	21.288	*19.304*	*1.984*	*10,28%*
Adisutjipto	Pesawat / *Aircraft*	68.729	*66.305*	*2.424*	*3,66%*
Adisoemarmo	Pesawat / *Aircraft*	25.413	*23.574*	*1.839*	*7,80%*
Syamsudin Noor	Pesawat / *Aircraft*	29.133	*30.702*	*(1.569)*	*-5,11%*
Ahmad Yani	Pesawat / *Aircraft*	57.089	*52.393*	*4.696*	*8,96%*
Lombok-Praya	Pesawat / *Aircraft*	27.759	*30.655*	*(2.896)*	*-9,45%*
Pattimura	Pesawat / *Aircraft*	16.847	*16.002*	*845*	*5,28%*
El Tari	Pesawat / *Aircraft*	20.448	*18.584*	*1.864*	*10,03%*
Jumlah		698.118	685.913	*12.205*	*1,78%*

(Sumber: PT. Angkasa Pura I, 2015)

Tabel 1. 2 Pergerakan Penumpang di Bandar Udara Indonesia

Bandara / Airport	Satuan / Unit	2015	*2014*	Kenaikan (Penurunan) / *Increase / (Decrease)*	% Perbandingan Terhadap 2014 / *Compared to 2014*
I Gusti Ngurah Rai	Orang / *Person*	17.108.387	*17.271.415*	*(163.028)*	*-0,94%*
Juanda	Orang / Person	17.143.912	*17.285.085*	*(141.173)*	*-0,82%*
Sultan Hasanuddin	Orang / Person	9.306.184	*8.848.354*	*457.830*	*5,17%*
S.A.M.S Sepinggan	Orang / Person	7.374.517	*7.701.216*	*(326.699)*	*-4,24%*
Frans Kasiepo	Orang / Person	361.410	*346.891*	*14.519*	*4,19%*
Sam Ratulangi	Orang / Person	2.113.737	*2.016.136*	*97.601*	*4,84%*
Adisutjipto	Orang / Person	6.380.336	*6.236.578*	*143.758*	*2,31%*
Adisoemarmo	Orang / Person	1.525.013	*1.417.576*	*107.437*	*7,58%*
Syamsudin Noor	Orang / Person	3.546.554	*3.714.463*	*(167.909)*	*-4,52%*
Ahmad Yani	Orang / Person	3.682.108	*3.469.395*	*212.713*	*6,13%*
Lombok-Praya	Orang / Person	2.552.399	*2.417.875*	*134.524*	*5,56%*
Pattimura	Orang / Person	1.318.041	*1.192.375*	*125.666*	*10,54%*
El Tari	Orang / Person	1.523.342	*1.310.734*	*212.608*	*16,22%*
		73.935.940	*73.228.093*	*707.847*	*0,97%*

(Sumber: PT. Angkasa Pura I, 2015)

Di era pemerintahan Presiden Joko Widodo, pembangunan infrastruktur transportasi sedang giat-giatnya dilakukan guna mempercepat pembangunan daerah di Indonesia dan pemerataan tingkat perekonomian ke setiap pelosok tanah air. Salah satu infrastruktur yang terus ditambah dan dikembangkan adalah infrastruktur perhubungan udara yaitu pembangunan bandara baru dan pengembangan fasilitas untuk bandara lama, seperti pembangunan bandara baru untuk Yogyakarta, pembangunan terminal baru dan *runway* baru untuk bandara Juanda, pembangunan kereta bandara Soekarno Hatta, ekspansi bandara Ahmad Yani Semarang serta pembangunan fasilitas bandara di Indonesia lainnya.

Dalam pembangunan tersebut dibutuhkan suatu perencanaan yang matang untuk menekan biaya penggunaan anggaran negara. Salah satu masalah yang sering timbul dalam perencanaan dan pelaksanaan proyek infrastruktur transportasi khususnya bandara adalah masalah topografi yang mempengaruhi perencanaan. Kemungkinan permasalahan timbul adalah perbedaan tinggi antara apron dan *runway*. Aturan kemiringan secara longitudinal sudah diatur pada dokumen ICAO maupun FAA, akan tetapi untuk perbedaan tinggi antara apron dan *runway* belum ditetepkan, artinya aka ada kemiringan pada *exit taxiway* dan area holding position. Hal tersebut membuat pihak perencana dan pelaksana proyek harus memutar otak untuk mengakali bagaimana agar proyek tersebut tetap dapat dilaksanakan dengan mempetimbangkan keamanan dan kenyaman penerbangan tanpa harus mengeluarkan biaya yang terlalu besar.

Konfigurasi *runway*, *taxiway* dan apron harus dirancang sedemikian rupa sehingga memiliki tingkat keselamatan yang tinggi. Salah satu masalah sering timbul adalah adanya perbedaan tinggi antara fasilitas apron dan *runway*. Untuk itu dibutuhkanlah perencanaan geometrik dari *taxiway* agar permasalahan perbedaan tinggi tersebut tidak menguras anggaran tanpa mengurangi tingkat keselamatan dan kenyamanan penerbangan.

Dalam suatu perencanaan bandara dengan topografi eksisting yang tidak beraturan dimana yang menghasilkan perbedaan tinggi antara *runway* dan apron, konfigurasi geometric adalah suatu hal yang harus direncanakan dengan sebaik mungkin dengan tetap memegang teguh tingkat kenyamanan dan minimalisasi biaya operasional dari maskapai. Sehingga perlu dipertimbangkan nilai avtur yang harus bertambah apabila pesawat keluar *runway* menuju apron karena ada perubahan elevasi tersebut.

1.2 Rumusan Masalah

Berdasarkan penjelasan tersebut dapat dirumuskan bahwa permasalahan pada perencanaan geometri *taxiway* dengan meninjau kontur tanah eksisting adalah sebagai berikut :

a. Bagaimanakah distribusi gaya yang bekerja pada roda pesawat untuk setiap tipe pesawat.
b. Berapakah kemiringan yang memungkinkan untuk holding position agar pesawat tidak tergelincir karena berat sendiri memasuki *runway*.
c. Apakah kecepatan pesawat saat keluar *runway* dapat melalui kemiringan *exit taxiway* dengan adanya perbedaan tinggi antara *runway* dan ujung *exit taxiway*.
d. Apakah pertambahan bahan bakar yang diperlukan untuk run engine keluar *runway* cukup signifikan pada *exit taxiway* yang memiliki kemiringan tertentu dibandingkan dengan *exit taxiway* yang datar.

1.3 Batasan Masalah

Dalam perencanaan geometri *taxiway* dengan meninjau kontur tanah eksisting ini dibatasi oleh waktu dan sumber yang tersedia. Oleh karena itu dibutuhkan batasan masalah agar tidak menjadi penyimpangan dalam pembahasan. Adapun beberapa batasan masalahnya adalah sebagai berikut:

1. Tidak merencanakan dan menganalisa struktur perkerasan *runway*, *taxiway* maupun apron
2. Tidak membahas dan memperhitungkan arah *runway*
3. Tidak membahas perencanaan infrastruktur bandara sisi darat
4. Untuk perhitungan dan analisa konsumsi bahan bakar, tidak memperhitungkan pesawat dengan jenis mesin turboprop
5. Untuk perhitungan dan analisa konsumsi bahan bakar hanya diperhitungkan di bagian Exit Taxiway.
6. Tidak memperhitungkan semua jenis pesawat, hanya pesawat yang beroperasi di Indonesia dan pesawat pabrikan terkemuka (Boeing dan Airbus).

1.4 Tujuan Tugas Akhir

Adapun tujuan dari Tugas Akhir ini adalah:

1. Mengetahui perencanaan geometrik fasilitas sisi udara (*runway*, *taxiway* dan apron) yang sesuai dengan meninjau topografi lahan
2. Memberikan bahan referensi perencanaan geometrik fasilitas sisi udara dengan meninjau topografi lahan tanpa mengurangi tingkat keselematan penerbangan
3. Memberikan rekomendasi terhadap perencanaan geometrik fasilitas sisi udara yang optimum khususnya gradien holding position dan *exit taxiway*

1.5 Manfaat Tugas Akhir

Adapun manfaat penulisan dari Tugas Akhir ini adalah:

1. Merupakan partisipasi penulis dalam memberikan kontribusi pengembangan ilmu pengetahuan khususnya dalam bidang transportasi.
2. Sebagai salah satu referensi dalam rangka perencanaan geometrik fasilitas sisi udara (*taxiway*) yang disesuaikan dengan topografi dengan menekankan tingkat keselamatan penerbangan dan biaya operasi maskapai.

BAB II
TINJAUAN PUSTAKA

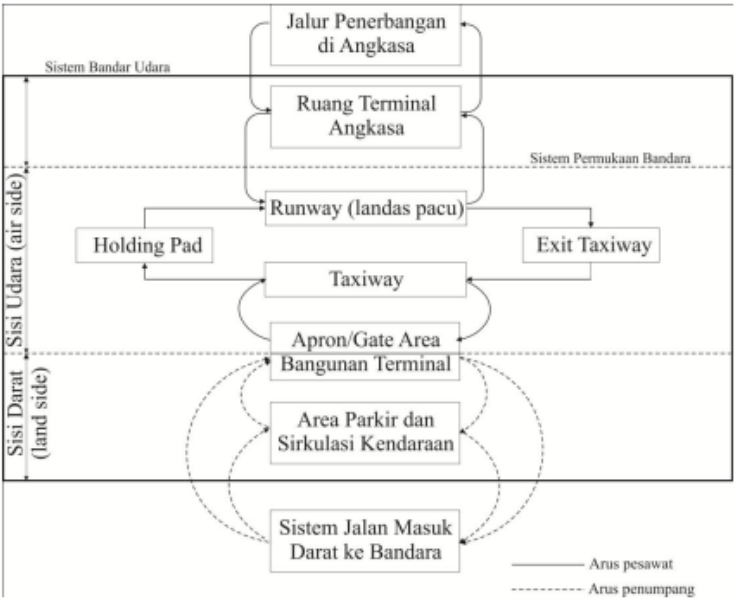
2.1 Perancangan Bandar Udara

2.1.1 Pengertian Bandar Udara

Bandar udara adalah suatu tempat atau daerah, di darat atau di perairan dengan batas-batas tertentu, termasuk bangunan dan instalasi, yang dibangun untuk keperluan pergerakan pesawat terbang lepas landas, pendaratan, atau pergerakan di permukaan (sumber : ICAO, 2018). Sistem bandar udara dibagi menjadi 2 bagian utama, yaitu: sisi darat (*land side*) dan sisi udara (*air side*). Sistem bandara pada sisi darat terdiri atas sistem jalan penghubung kendaraan (jalan masuk ke bandara), lapangan parkir kendaraan dan terminal penumpang. Sedangkan sistem bandara pada sisi udara meliputi *runway*, *apron*, *taxiway*. Lingkup kegiatan pada bandar udara sangat luas, sehingga secara umum fungsi bandar udara dapat disimpulkan sebagai berikut:

a. Melayani, mengatur dan mengawasi lalu-lintas udara, baik yang datang, berangkat maupun transit.
b. Menyimpan, mengurus dan mengatur muatan, baik yang berasal dari angkutan darat yang dipindahkan ke angkutan udara atau sebaliknya.
c. Menyediakan dan memelihara fasilitas bandar udara, telekomunikasi, navigasi udara dan listrik.
d. Menyelenggarakan dan mengendalikan keamanan dan ketertiban umum di bandar udara.

Berikut merupakan skema sistem bandar udara disajikan dalam Gambar 2.1.



Gambar 2. 1 Sistem Bandar Udara
(Sumber*: Basuki, 198*6)

2.1.2 Rancangan Induk Bandar Udara

Rancangan Induk Bandara Udara *(Airport Masterplan)* merupakan suatu konsep perancangan pengembangan lapangan terbang ter-mutakhir dari suatu bandar udara. Pengertian pengembangan bukan saja ditinjau dalam hal lingkungan lapangan terbang, akan tetapi seluruh area fasilitas bandar udara baik fasilitas sisi udara maupun fasilitas sisi darat. Tujuan umum dari rancangan induk bandar udara adalah memberikan pedoman untuk pengembangan di kemudian hari yang lebih memadai bagi operasi penerbangan yang selaras dengan lingkungan dan pengembangan masyarakat serta moda transportasi lainnya. (*Basuki, 1986*)

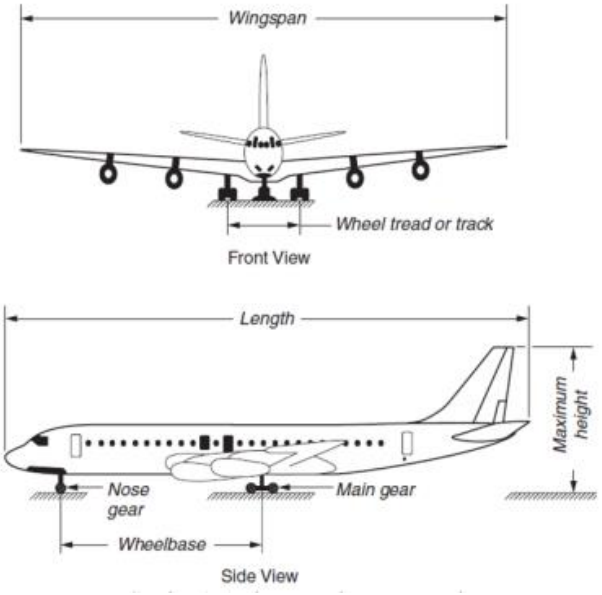
Dalam konteks yang lebih detail, rancangan induk bandar udara dapat dipergunakan sebagai pedoman untuk:

a. Pengembangan fasilitas fisik sebuah bandar udara
b. Tata guna lahan dan pengembangannya di dalam dan di sekitar bandar udara
c. Menentukan Pengaruh lingkungan dari pembangunan bandar udara dan operasional penerbangan bandara tersebut.
d. Pembangunan untuk kebutuhan jalan masuk.
e. Pengembangan kegiatan ekonomi dan kegiatan lainnya yang berpeluang menghasilkan pendapatan bagi pengelola bandar udara.
f. Pembagian fase dan kegiatan prioritas yang bisa dilaksanakan oleh pengelola yang sesuai dengan rancangan induk bandar udara yang sudah ada.

2.2 Karakteristik Pesawat Terbang

Karakteristik pesawat terbang merupakan aspek yang signifikan dalam penentuan perencanaan dan pembangunan *runway*. Klasifikasi dan spesifikasi pesawat akan menentukan tebal perkerasan, metode perencanaan di lapangan.

Pada Gambar 2.2 disajikan elemen-elemen yang digunakan dalam perencanaan suatu bandara antara lain, panjang, jarak antar *gear*, *wingspan*, tinggi maximum, dan *wheel base*.



Gambar 2. 2 Elemen Pada Pesawat Terbang
(Sumber *: Horonjeff & McKelvey. 2010)*

Adapun karakteristik pesawat terbang yang dibutuhkan adalah :

a. Berat (Weight)
   Berat pesawat diperlukan untuk merencanakan tebal perkerasan dan kekuatan landasan pacu.
b. Ukuran (Size)
   Lebar dan panjang pesawat (*Fuselag*) mempengaruhi dimensi landasan pacu.

c. Kapasitas Penumpang
   Kapasitas penumpang berpengaruh terhadap perhitungan perencanaan kapasitas landasan pacu.
d. Panjang Landasan Pacu
   Berpengaruh terhadap luas tanah yang dibutuhkan suatu bandar udara.

Anggapan bahwa makin besar pesawat terbang, makin panjang landasan tidak selalu benar. Bagi pesawat besar, yang sangat menentukan kebutuhan panjang landasan adalah jarak yang akan ditempuh sehingga menentukan berat lepas landas (*Take Off Weight*). Karakteristik dari beberapa pesawat terbang dapat dilihat pada Tabel 2.1.

Tabel 2. 1 Karakteristik Pesawat Terbang

Pesawat Terbang	Bentang Sayap	Panjang Pesawat	Jarak Roda	Berat Lepas Landas (pon)	Berat Landing Maks (pon)	Berat Kosong Operasi (pon)	Berat Bahan Bakar Kosong (pon)	Muatan Maks. Penumpang	Panjang Runway (ft)
ATR42-300	88'07"	74'05"	13'05"	36.815	36.155	22.674	34.259	42 – 50	3.576
ATR-72	88'09"	89'02"	13'05"	47.4	47.068	27.337	43.43	64 – 70	4.62
DC-9-32	93'04"	119'04"	53'02"	108	99	56.855	87	115 – 127	7.5
DC-9-50	93'04"	132'00"	60'11"	120	110	63.328	98	130	7.1
DC-9-80	107'10"	135'06"	72'05"	140	128	77.797	118	155 – 172	7.19
DC-8-61	148'05"	187'05"	77'06"	325	240	152.101	224	196 –259	11
DC-8-63	148"05'	187'05"	77'06"	355	258	158.738	230	196 – 259	11.9
DC-10-10	155'04"	182'03"	72'05"	430	363.5	234.664	335	270 –345	9
DC-10-30	161'04"	181'07"	72'05"	555	403	261.094	368	270 –345	11
B737-200	93'00"	100'00"	37'04"	100.5	98	59.958	85	86 – 125	5.6
B737-300	94'09"	109'07"	40'10"	124.5	114	69.4	105	128 – 149	6.3
B727-200	108'00"	153'02"	63'03"	169	150	97.4	138	134 – 163	8.6
B720B	130'10"	136'09"	50'08"	234.3	175	115	156	131 – 149	6.1
B707-120B	130'00"	145'01"	52'04"	257.34	190	127.5	170	137 – 174	7.5
B707-320B	142'05"	152'11"	59'00"	333.6	215	148.8	195	141 – 189	11.5
B757-200	124'06"	153'10"	60'00"	220	198	130.7	184	178 – 196	6.9
B767-200	156'01"	159'02"	64'07"	315	272	176.65	250	216 – 255	6
B767-300	156'01"	180'03"	74'08"	345	300	186.378	278	261 – 290	8
B777-200	199'11"	209'01"	84'11"	535	445	299.55	420	305 – 375	8.7
B787-8DL	197'04"	186'02"	74'09"	242				230	9.6
B747-B	195'09"	229'02"	84'00"	775	564	365.8	526	362 – 490	11
B747-SP	195'09"	176'07"	67'04"	650	450	308.4	410	288 – 364	8
B747-100	195'08	231'10"	84'00"	710	564	358	526.5	452 – 480	9.5
B747-200B	195'08"	231'10"	84'00"	775	564	381.15	526.5	452 – 480	12.2
B747-300	195'08	231'10"	84'00"	710	564	390.3	536.5	565 – 608	7.7
B747-400	213'00"	231'10"	84'00"	800	574	396.142	535	400	8.8
A300	147'01"	175'11"	61'01"	302	281	186.81	256.83	225 – 345	6.5
A310	144'00"	153'01"	40'11"	291	261.25	168.91	239.2	205 – 265	6.1
A320	111'03"	123'03"	41'05"	158.73	134.48	84.171	125.662	138 – 179	5.63
A340	197'10"	195'00"	62'11"	558.9	399	270.7	372.5	262 – 375	7.6
A380	261'08"	239'08"	99'08"	1.235.000				525	10

(Sumber : *Horonjeff dan McKelvey, 2010*)

2.2.1 Berat Pesawat Terbang dan Distribusi Beban Ke Roda

Beberapa komponen dari berat pesawat terbang yang paling menentukan dalam menghitung panjang landas pacu dan kekuatan perkerasannya, yaitu:

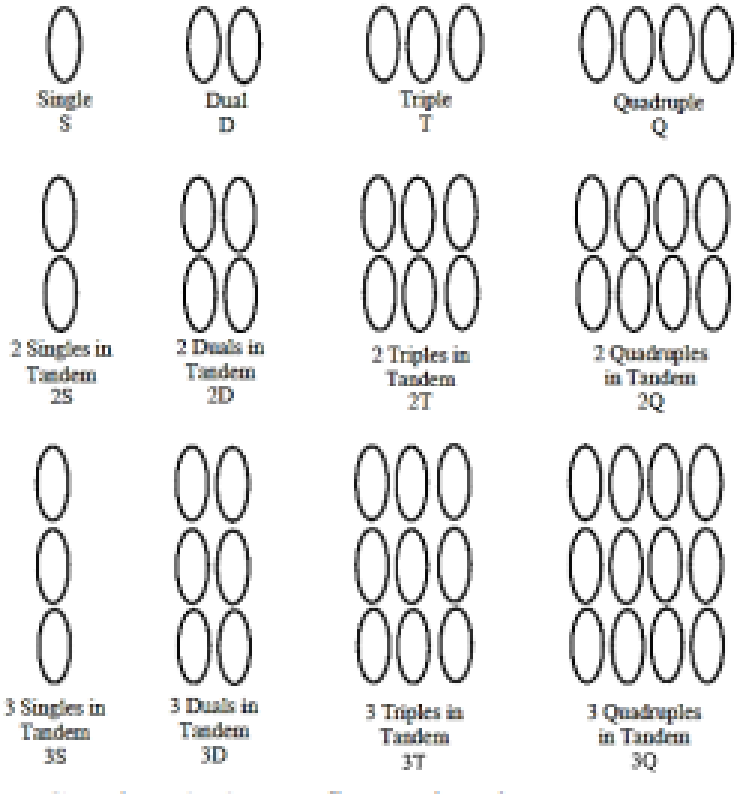
a. Operating Weight Empty
   Adalah berat dasar pesawat terbang, termasuk di dalamnya *crew* dan peralatan pesawat terbang, tetapi tidak termasuk bahan bakar dan penumpang atau barang yang membayar.
b. Pay Load
   Adalah produksi muatan (barang atau penumpang) yang membayar, diperhitungkan menghasilkan pendapatan bagi perusahaan. Pertanyaan yang sering muncul, berapa jauh pesawat bisa terbang, jarak yang bisa ditempuh pesawat disebut jarak tempuh (*range*). Banyak faktor yang mempengaruhi jarak tempuh pesawat, yang paling penting adalah *pay load*. Pada dasarnya *pay load* bertambah, jarak tempuhnya berkurang atau sebaliknya *pay load* berkurang, jarak tempuh bertambah.
c. Zero *Fuel* Weight
   Adalah batasan berat, spesifik pada tiap jenis pesawat, di atas batasan berat itu tambahan berat harus berupa bahan bakar, sehingga ketika pesawat sedang terbang, tidak terjadi momen lentur yang berlebihan pada sambungan.
d. Maximum Structural Landing Weight
   Adalah kemampuan struktural dari pesawat terbang pada waktu melakukan pendaratan.
e. Maximum Structural Take Off Weight
   Adalah berat maximum pesawat terbang termasuk didalamnya *crew*, berat pesawat kosong, bahan bakar, pay load yang diizinkan pabrik, sehingga momen tekuk yang terjadi pada badan pesawat terbang, ratarata masih dalam batas kemampuan yang dimiliki oleh material pembentuk pesawat terbang.

f. Berat Statik Main Gear dan Nose Gear
   Pembagian beban statik antara roda pendaratan utama (*main gear*) dan *nose gear*, tergantung pada jenis/tipe pesawat dan tempat pusat gravitasi pesawat terbang. Batas-batas dan pembagian beban disebutkan dalam buku petunjuk tiap-tiap jenis pesawat terbang, yang mempunyai perhitungan lain dan ditentukan oleh pabrik.

2.2.2 Konfigurasi Roda Pesawat

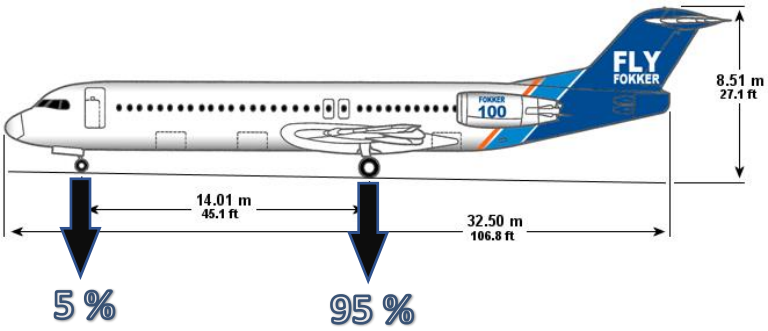
Konfigurasi roda pada pesawat merupakan sistem penyusunan roda pada pesawat yang diatur sedemikian rupa sehingga beban pesawat terbang keseluruhan dapat dipikul dengan merata pada setiap roda pendaratan. Pengaturan ini dibuat agar pesawat yang memiliki beban besar tidak menimbulkan kerusakan pada landas pacu ketika beroperasi. Konfigurasi roda pesawat terbang memiliki kode-kode tertentu untuk memudahkan mengenalinya.

Untuk roda tunggal disebut *single (S)*, untuk roda ganda disebut *double (D)*, untuk roda rangkap tiga disebut *triple (T)*, sedangkan untuk roda rangkap empat disebut *quadruple (Q)*. Konfigurasi roda berdasarkan jumlah sumbu pada pesawat disajikan pada Gambar 2.3.



Gambar 2. 3 Konfigurasi Roda Secara Umum Berdasarkan Jumlah Sumbu
(Sumber *: Federal Aviation Administration, 2005)*

Dalam perancangan suatu fasilitas sisi udara dibutuhkanlah beban berat dari pesawat yang kemudian didistribusi ke dalam roda pesawat. Hal ini bertujuan untuk memberikan berat beban yang akan dipukul oleh perkerasan dari fasilitas sisi udara. Mayoritas tipe pesawat menerapkan sistem 95 % beban utama dipikul oleh roda pendaratan utama (*Main Landing Gear)* dan beban lainnya sebesar 5 % dipikul oleh roda depan pesawat (*Nose Landing Gear)* seperti yang disajikan dalam gambar 2.4. Sedangkan angka konversi antar gandar berbeda-beda tergantung dari gandar pesawat yang dibutuhkan. Konversi factor beban pesawat dari suatu gandar terhadap gandar lainnya tersaji dalam Tabel 2.2.



Gambar 2. 4 Ilustrasi Distribusi Beban Terhadap Konfigurasi Roda.

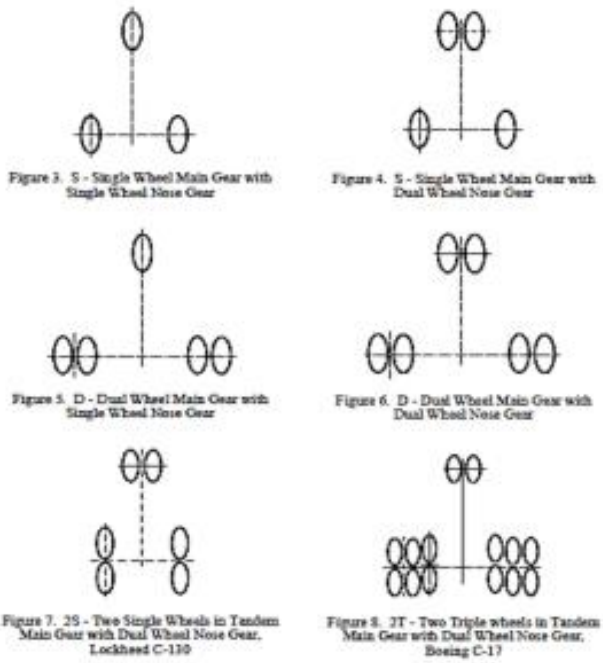
(Sumber *: Federal Aviation Administration, 2005)*

Tabel 2. 2 Konversi Gandar Roda Pendaratan

Konversi dari-	Konversi ke-	Faktor Konversi
Single Wheel	Dual Wheel	0.8
Single Wheel	Dual Tandem	0.5
Dual Wheel	Dual Tandem	0.6
Double Dual Tandem	Dual Tandem	1.0
Dual Tandem	Single Wheel	2.0
Dual Tandem	Dual Wheel	1.7
Dual Wheel	Single Wheel	1.3
Double Dual Tandem	Dual Wheel	1.7

(Sumber *: Federal Aviation Administration, 2005*)

Berikut adalah contoh konfigurasi roda pesawat terbang berdasarkan jumlah sumbu. Semakin besar tipe pesawat (*Wide Body Aircraft)*, maka semakin banyak pula jumlah as dan semakin banyak pengataturan konfigurasinya. Beban yang besar tidak akan merusak landas pacu jika beban tersebut di terima dan di distribusikan merata oleh banyak roda pendaratan utama (*Main landing Gear)*. Konfigurasi roda pesawat terbang dapat dilihat pada Gambar 2.5, Gambar 2.6 serta pada Tabel 2.3 dan 2.4.



Gambar 2. 5 Konfigurasi roda pesawat terbang pada tipe pesawat berbadan sempit
(Sumber *: Federal Aviation Administration, 2005)*

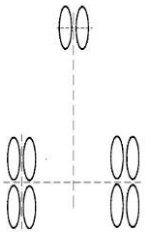


Figure 9. 2D - Two Dual Wheels in Tandem Main Gear with Dual Wheel Nose Gear

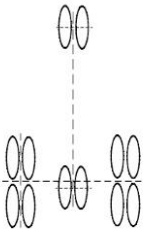


Figure 10. 2D/D1 - Two Dual Wheels in Tandem Main Gear/Dual Wheel Body Gear with Dual Wheel Nose Gear, McDonnell Douglas DC-10, Lockheed L-1011

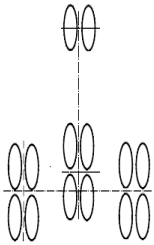


Figure 11. 2D/2D1 Two Dual Wheels in Tandem Main Gear/Two Dual Wheels in Tandem Body Gear with Dual Wheel Nose Gear, Airbus A340-600

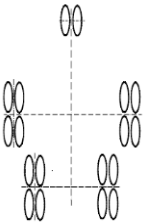


Figure 12. 2D/2D2 - Two Dual Wheels in Tandem Main Gear/Two Dual Wheels in Tandem Body Gear with Dual Wheel Nose Gear, Boeing B-747

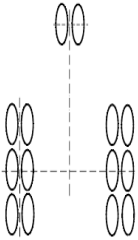
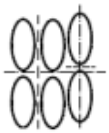


Figure 13. 3D - Three Dual Wheels in Tandem Main Gear with Dual Wheel Nose Gear, Boeing B-777

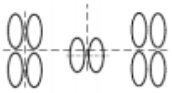
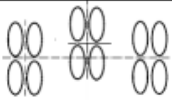
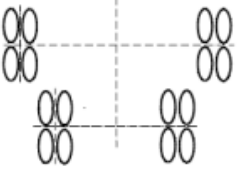
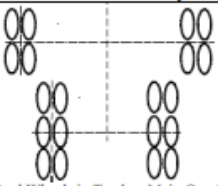
Gambar 2. 6 Konfigurasi Roda Pesawat terbang pada tipe pesawat berbadan lebar
(Sumber *: Federal Aviation Administration, 2005*)

Tabel 2. 3 Standar Penamaan Konfigurasi Umum Gandar Pesawat

Gear Designation	Gear Designation	Airplane Example
S	 Single	Sngl Whl-45
D	 Dual	B737-100
2S	 2 Singles in Tandem	C-130
2D	 2 Duals in Tandem	B767-200
3D	 3 Duals in Tandem	B777-200
2T	 Two Triple Wheels in Tandem	C-17A

(Sumber *: Federal Aviation Administration, 2005)*

Tabel 2. 4 Standar Penamaan Konfigurasi Umum Gandar Pesawat dengan Sumbu

Gear Designation	Gear Designation	Airplane Example
2D/D1	 Two Dual Wheels in Tandem Main Gear/Dual Wheel Body Gear	DC10-30/40
2D/2D1	 2D/2D1 Two Dual Wheels in Tandem Main Gear/Two Dual Wheels in Tandem Body Gear	A340-600 std
2D/2D2	 Two Dual Wheels in Tandem Main Gear/Two Dual Wheels in Tandem Body Gear	B747-400
2D/3D2	 Two Dual Wheels in Tandem Main Gear/Three Dual Wheels in Tandem Body Gear	A380-800
5D	 Five Dual Wheels in Tandem Main Gear	An-124

(Sumber *: Federal Aviation Administration, 2005*)

2.3 Perancangan Geometrik Runway

Landas pacu (*runway)* adalah jalur perkerasan yang dipergunakan oleh pesawat terbang untuk mendarat *(take off)* dan lepas landas *(landing)*. Sistem landas pacu *(runway)* suatu bandar udara terdiri dari perkerasan struktur, bahu landasan *(shoulder)*, bantalan hembusan *(blast pad)*, dan daerah aman landasa pacu *(runway end safet area)*. Pada bandar udara yang harus diperhatikan adalah panjang, jumlah, lebar, jarak terhadap landas hubung *(taxiway)* dan landas parkir *(apron)*, dan orientasi arah landas pacu terhadap angin. (*Horonjeff, 2010*)

2.3.1 Jarak Pemisahan Runway Rencana

Arti dari pemusahan *runway* disini adalah jarak antara *runway* dengan halangan berupa objek atau fasilitas bandara lainnya, contohnya yaitu landasan hubung atau *taxiway*. Pemisahan ini adalah jarak antara garis tengah (centerline) *runway* dengan garis tengah (centerline) *taxiway*. Sementara pemisahan lain adalah pemisahan pesawat yang sedang melakukan holding di *taxiway* dan garis tengah *runway*, pemisahan ini disebut holdline. Pemisahan lainnya adalah jarak antara garis tengah *runway* dan area parkir pesawat. Ketiga pemisahan tersebut didapatkan dari tabel pada dokumen SKEP 77 2005 seperti yang tertera pada Tabel 2.5.

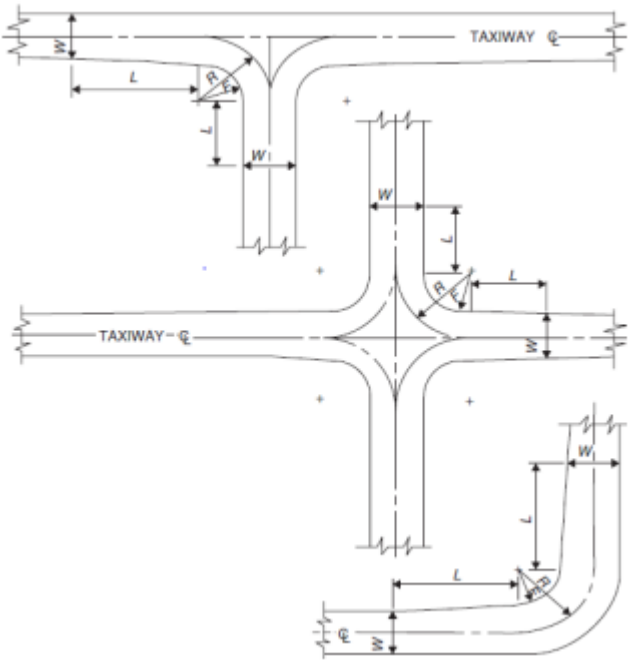
Tabel 2. 5 Standar Pemisahan Untuk Pesawat Kategori Approach C & D

Uraian	Penggolongan Pesawat					
	I	II	III	IV	V	VI
Instrumen non-presisi dan garis tengah *Runway* visual (m)						
1. Holdline	75	75	75	75	75	75
2. Garis Tengah *taxiway* / taxilane (D)	90	90	120	120	2/	180
3. Area parkir pesawat (G)	120	120	150	150	150	150
Instrumen presisi dan garis tengah *runway* visual (m)						
1. Holdline	75	75	75	75	85	98
2. Garis Tengah *taxiway* / taxilane (D)	150	120	120	120	2/	180
3. Area parkir pesawat (G)	150	150	150	150	150	150

(Sumber : *Dirjen Perhubungan Udara, 2005*)

2.4 Perancangan Geometrik Taxiway

Taxiway didefinisikan sebagai jalur pada permukaan sisi udara bandar udara yang digunakan ntuk pesawat melakukan *taxiing* dan menjadi penghubung antara bagian bandara yang satu dengan yang lain. Dual parallel *taxiway* merujuk pada parallel *taxiway* juga digunakan sebagai prasarana pesawat *taxiing* secara berlawanan. *(Horenjeff/Mckelvey, 2010).* Dari beberapa peraturan didapatkan beberapa tipe *taxiway intersection* seperti yang tertera dalam Gambar 2.7.



Gambar 2. 7 *Taxiway* Intersection
(Sumber*: Ashford et al., 2011)*

2.4.1 Taxilane

Taxilane merupakan sebuah bagian dari area parkir pesawat yang dipergunakan sebagai akses antara *taxiway* dan area parkir pesawat. (*Ashford et al., 2011)*

2.4.2 Kecepatan Pesawat di Taxiway

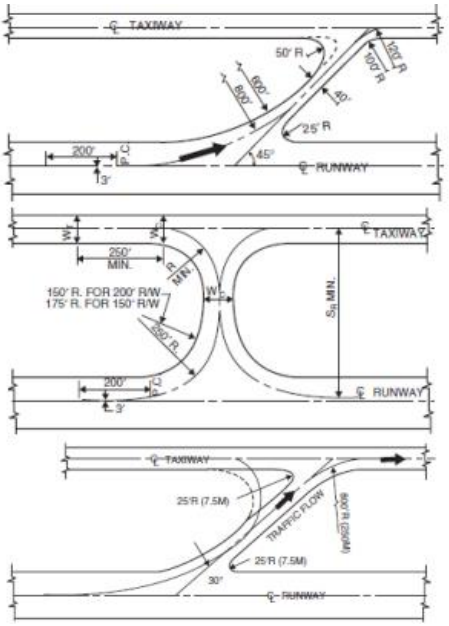
Rute taixway sebaiknya lurus, langsung dan tidak rumit. Dimana jika ada tikungan pada *taxiway* yang tidak bisa dihindarkan, radius nya juga harus cukup besar untuk dilewati kecepatan pesawat ketika *taxiing* (*taxiing speed)* pada 20-30 mph/17-26 knot. (*Ashford et al, 2011)*

Ketika melakukan *taxiing*, pesawat berjalan lebh pelan. Ini dilakukan untuk memastika bahwa pesawat dapat berhenti lebih cepat dan tidak mengambil resiko merusak mesin roda pada pesawat yang lebih besar jika tiba-tiba mereka ke samping jalan/permukaan trotoar taxilane. Kecepatan pada saat *taxiing* umumnya berkisar antara 5 hingga 20 knot (9 hingga 37 km/jam; 6 hingga 23 mil/jam). *(Ishutkina et al, 2010)*

2.4.3 Exit Taxiway

Exit taxiway berguna untuk mengurangi penggunaan *runway* oleh pesawat yang mendarat. *Exit taxiway* bisa ditempatkan pada sudut ke arah *runway* atau beberapa sudut yang lain. *Exit taxiway* dibagi menjadi dua berdasarkan kecepatan pesawat yang lewat yakni jenis *high-speed exit* dan *right angle exit* (kecepatan rendah). Pada sejumlah bandara, *exit taxiway* terletak tegak lurus terhadap *runway*, sehingga pesawat harus memperlambat kecepatannya agar aman saat keluar dari *runway*. Ketika *exit taxiway* memiliki sudut 30°, kecepatan pesawat umumnya berada pada kecepatan yang tinggi dan disebut *rapid exit taxiway*.*(Horenjeff, 2010)*

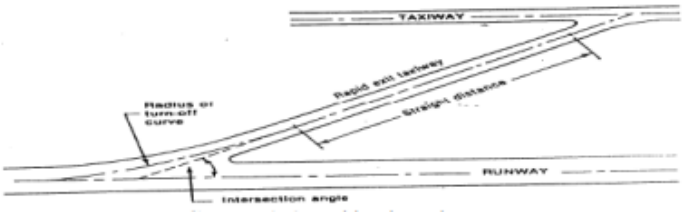
Pada umumnya *exit taxiway* memiliki 3 tipe. *Exit Taxiway* yang tegak lurus biasanya digunakan ketika perancangan lalu lintas pergerakan pesawat saat peak hour hanya 30 pesawat. Pada bandara modern, untuk mempercepat pergerakan pesawat yang mendarat dari *runway*, pihak bandar udara menyediakan *exit taxiway* yang memiliki sudut pada tengah *runway*. *Exit taxiway* yang bersudut 45° terhadap garis tengah *runway* direkomendasikan untuk pesawat kecil. Tipe yang digunakan untuk mempercepat kegiatan operasi dan pergerakan pesawat seperti yang terlihat pada Gambar 2.8. *Exit taxiway* ini akan mengakomodasi kecepatan pesawat di 40 mph atau 35 knot. Konfigurasi *exit taxiway* lainnya adalah yang bersudut 30°, jenis tipe ini dapat mengakomodasi kecepatan pesawat hingga 60 mph atau 53 knot. (*Ashford et al, 2011)*



Gambar 2. 8 Exit Taxiway
(Sumber: Ashford et al., 2011)

2.4.4 Rapid Exit Taxiway

Rapid *Exit Taxiway* adalah *exit taxiway* kecepatan tinggi yang fungsinya sama dengan *exit taxiway* dan ditempatkan menyudut lebih kecil dari 45° dan lebih besar dari 25° terhadap garis tengah landasan pacu. Ketka mengetahui jenis *exit taxiway* yang ada, seorang perencana dapat menentukan pesawat beroperasi akan bergerak dengan kecepatan berapa saat berjalan di *exit taxiway*. Contoh geometric dari Rapid *Exit Taxiway* seperti yang tertera pada Gambar 2.9.



Gambar 2. 9 Rapid Exit Taxiway
(Sumber*: Ashford et al., 2011)*

2.4.5 Lebar Taxiway

Desain dari *taxiway* harus memiliki factor keamanan yang diizinkan karena pergerakan pesawat sangat cepat, ketika cockpit menuju *taxiway* yang diperhatikan garis tengah dari *taxiway*, jarak diantaranya harus terbebas dari hambatan terutama yang diluar roda pesawat dan ujung *taxiway*, nilai minimum untuk dimensi *taxiway* dan taxilane diberikan seperti pada Tabel 2.6 dan 2.7.

Tabel 2. 6 . Dimensi Taxiway

Code Letter	Penggolongan Pesawat	Lebar Taxiway (m)	Jarak bebas minimum dari sisi terluar roda utama dengan tepi taxiway (m)
A	I	7.5	1.5
B	II	10.5	2.25
C	III	15[A]	3[A]
		18[B]	4.5[B]
D	IV	18[C]	4.5
		23[D]	
E	V	25	4.5
F	VI	30	4.5

(Sumber: Dirjen Perhubungan Udara, 2005)

Keterangan:

a. Bila *taxiway* digunakan pesawat dengan roda dasar kurang dari 18 m
b. Bila *taxiway* digunakan pesawat dengan seperempat roda dasar lebih dari 18 m
c. Bila *taxiway* digunakan pesawat dengan roda putaran kurang dari 9 m
d. Bila taxiway untuk pesawat dengan seperempat roda putaran lebih dari 9 m

Tabel 2. 7 Standar Minimum Taxiway dan Taxilane Separation

Uraian	Penggolongan Pesawat					
	I	II	III	IV	V	VI
Garis Tengah Taxiway						
a. Taxiway Paralel / garis tengah taxilane	21	32	46.5	65.5	81	99
b. Fixed or movable object 1 dan 2	13.5	20	28.5	39.5	48.5	59
Garis Tengah Taxilane						
a. Garis Tengah parallel taxilane (m)	19.5	29.5	42.5	60	74.5	91
b. Fixed or movable object 1 dan 2	12	17.5	24.5	34	42	51

(Sumber: Dirjen Perhubungan Udara, 2005)

Keterangan:

1. Nilai ini berlaku juga bagi tepi jalan pemeliharaan dan layanan
2. Pertimbangan yang menyangkut mesin dan putaran pesawat harus diberikan pada objek terdekat persimpangan dari *runway* /*taxiway*/ taxilane

2.4.6 Jarak Pandang dan Profil Memanjang

Seperti halnya landasan pacu, jumlah perubahan profil memanjang dibatasi oleh jarak pandang dan jarak minimum antara kurva-kurva vertical. Sehubungan dengan jarak pandang, ICAO menetapkan bahwa permukaan *taxiway* harus dapat dilihat untuk jarak sejauh 1000 kaki dari suatu titik yang terletak 10 kaki di atas *taxiway* untuk kode C, D dan E. Untuk landasan kode A dan B, jarak pandang adalah 650 kaki dari ketinggian 7 kaki. Sedangkan FAA tidak menentukan jarak pandang untuk *taxiway*.

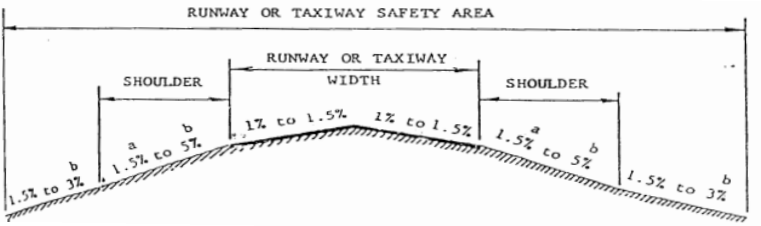
Sehubungan dengan profil memanjang taxiway, ICAO tidak menentukan jarak minimum antara titik potong kurva-kurva tertikal. Sedangkan FAA menetapkan bhawa jarak minimum untuk bandar udara kategori transport tidak boleh lebih kecil dari hasil kali 1000 kaki dengan jumlah nilai persentase mutlak untuk perubahan kemiringan *(Horenjeff & Mckelvey, 2010)*

Disamping itu, persyaratan yang dibuat ICAO untuk mengatur kemiringan dan jarak pandang (*Sight Distance)*, serta kemiringan melintang adalah seperti Tabel 2.8, Gambar 2.10 dan Gambar 2.11.

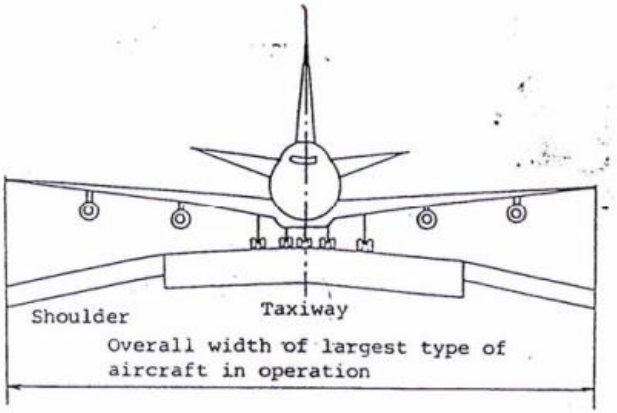
Tabel 2. 8 Kemiringan dan Jarak Pandang Taxiway

	Code Letter				
	E	D	C	B	A
Kemiringan Memanjang Maximum	1.5 %	1.5 %	1.5 %	3 %	3 %
Perubahan Kemiringan Memanjang Maximum	1% per 30 m	1% per 30 m	1% per 30 m	1% per 25 m	1% per 25 m
Jarak Pandangan Minimum	300 m dari 3 m diatas	300 m dari 3 m diatas	300 m dari 3 m diatas	300 m dari 2 m diatas	300 m dari 1.5 m diatas
Kemiringan Transversal Maximum dari Taxiway	1.5 %	1.5 %	1.5 %	2 %	2 %
Kemiringan Transversal Maximum dari bagian yang diratakan pada Strip Taxiway					
a. Miring ke atas	2.5 %	2.5 %	2.5 %	3 %	3 %
b. Miring ke bawah	5 %	5 %	5 %	5 %	5 %

(Sumber: Basuki, 1986)



Gambar 2. 10 Kemiringan Melintang Taxiway
(Sumber : Dirjen Perhubungan Udara, 2005)



Gambar 2. 11 Penampang Kemiringan Melintang Taxiway
(Sumber : Dirjen Perhubungan Udara, 2005)

2.5 Kekesatan dan Kekasaran Permukaan Perkerasan

2.5.1 Pengujian Kekesatan Permukaan Perkerasan

Skid Resistance (tahanan gelincir) adalah gaya yang dihasilkan antara muka jalan dan ban untuk mengimbangi majunya gerak kendaraan jika dilakukan pengereman (Sukirman, S., 1999). *Skid Resistance* merupakan nilai gesekan yang terjadi antara permukaan perkerasan dan roda kendaraan. Nilai gesekan ini tergantung pada: tekstur mikro dan makro permukaan jalan, material penyusun dari ban, kecepatan kendaraan dan kondisi cuaca. (Yero, S., et al., 2012). Nilai *Skid Resistance* dapat didapatkan melalui percobaan menggunakan alat, berikut ini adalah peralatan yang dapat digunakan untuk mendapatkan nilai *Skid Resistance* (Lu Qing dan Bruce Steven, 2006):

1. Locked-Wheel Skid Trailer

   Pengujian dengan *Locked Wheel Trailer* dilakukan untuk menghitung gaya gesek pada ban uji dalam keeadan terkunci. Ban tersebut digerakan dengan beban yang tetap dan kecepatan konstan (64 km/h atau 40 mph) di atas permukaan perkerasan yang basah. Pada uji ini permukaan perkerasan di depan ban yang sedang berjalan disiram air untuk mendapatkan kondisi permukaan perkerasan basah. Gesekan permukaan perkerasan didapatkan dari gaya yang dihasilkan dan dipresentasikan dalam satuan *skid number* (SN).

2. British Pendulum Tester

   BPT merupakan alat uji jenis bandul (pendulum) dinamis, digunakan untuk mengukur energi yang hilang pada saat karet di bagian bawah telapak bandul menggesek permukaan yang diuji. Alat ini dimaksudkan untuk pengujian pada permukaan yang datar di lapangan atau laboratorium, dan untuk mengukur nilai pemolesan (*polishing value*) pada benda uji berbentuk lengkung. Satuan nilai kekesatan yang diukur dengan alat BPT adalah *British Pendulum Number* (BPN), baik untuk permukaan uji datar atau nilai pemolesan untuk benda uji lengkung. Nilai ini mempresentasikan sifatsifat hambatan atau gesekan (*frictional*) (SNI 4427, 2008).

3. Mu-Meter

Cara pengukuran kekesatan (*the side force friction*) permukaan perkerasan ini menggunakan alat yang biasanya disebut Mu-meter. Uji kekesatan ini dilakukan dengan menarik alat Mu-meter pada kecepatan tetap pada sudut arah gerakan tertentu di atas permukaan perkerasan dalam keadaan basah. Alatnya terdiri atas dua roda penguji dan dapat berputar bebas, yang dibebani dengan beban statis. Pencatat dalam alat ini merekam grafik kekesatan yang menerus untuk seluruh panjang permukaan yang diuji, dan pada segmen tertentu mungkin diperoleh grafik yang merata. (SNI 6748, 2008).

Kekesatan/Skid Resitance diukur dengan mengukur friksi roda dan permukaan perkerasan dalam kondisi basah dengan alat Mu-Meter. Pengujian dilakukan dengan terus menerus hingga menghasilkan grafik hubungan nilai SFC (Side force Coefisien) dan permukaan perkerasan. Nilai SFC versi GG.Giles disajikan dalam Tabel 2.9.

Tabel 2. 9 Nilai SFC dengan alat Mu-meter berdasarkan GG.Giles.

Nilai SFC	Resiko Yang Terjadi
> 0.60	Kemungkinan kecelakaan sangat kecil, permukaan perkerasan dapat dikatakan kasar.
0.55 – 0.60	Kemungkinan kecelakaan akan mulai terjadi, permukaan perkerasan masih kondisi kasar.
0.40 – 0.55	Kecelakaan terjadi dan resiko fatal terjadi dalam bentuk slip

(Sumber: Dirjen Perhubungan Udara, 2005)

Angka Skid Resistance yang direkomendasikan untuk operasional permukaan perkerasan adalah > 0.60 dengan ala MU-meter

4. Grip Tester

Grip Tester merupakan alat berupa troli yang telah dipasangkan dengan alt berupa grip yang akan menguji tingkat cengkraman dari perkerasan, troli ini kemudian dihubungkan dengan kendaraan yang kemudian melaju dengan kecepatan tertentu yang diisyaratkan. Contoh alat Grip Tester yang biasa digunakan seperti yang terlihat pada Gambar 2.12. Kecepatan yang digunakan dalam pengetesan ini biasanya adalah 65 km/h dan 95 km/h. Menurut Annex14-Aedromes, angka kekesatan/*skid Resistance* yang menjadi rekomendasi untuk operasional permukaan perkerasan yang diuji dengan alat Grip Tester adalah berkisar antara 0.74 – 0.53.

Gambar 2. 12 Alat Grip Tester
(Sumber : www.google.com, 2018)

2.5.2 Nilai Kekesatan dan Kekasaran Permukaan

A. Nilai Kekesatan Permukaan Perkerasan (*Skid Resistance*)

Melalui SKEP 76-VI-2005, Direktorat Jendral Perhubungan Udara mengeluarkan standar bahwa untuk melakukan operasi transportasi udara internasional diisyaratkan menggunakan alat pengukuran kekesaran berkelanjutan yang telah disetujui oleh ICAO yang memilki fitur untuk membasahi sendiri (*Self-Wetting*) untuk mengukur tingkat kekasaran *runway* dan fasilitas sisi udara lainnya.

Runway dan fasilitas sisi udara lainnya harus dievaluasi ketika awal pembangunan atau setelah tahap pelapisan ulang untuk menentukan karakteristik kekasaran permukaan pada saat kritis atau saat basah. (Dirjen Perhubungan Udara, 2005)

Hasil dari pengukuran tingkat kekesatan perkerasan ini dapat digunakan untuk memverifikasi karakteristik kekesatan dari permukaan yang baru dibangun atau yang baru dilakukan pelapisan ulang. Setelah dilakukan pengukuran, jika tingkat kekesatan yang didapat dibawah nilai *Maintenance Planning Level,* maka operator bandara harus melakukan tindakan berupa pemeliharaan korektif untuk tingkat kekesatan ini. Sedangkan jika hasil pengukuran dibawah nilai *minimum friction level* maka operator bandara harus melakukan tindakan pemeliharaan korektif tanpa menunda, syarat ini diberlakukan pada karakteristik kekesesatan sebagian perkerasan ataupun secara keseluruhan. Adapun angka *maintenance friction level* dan *minimum friction level* terdapat pada Tabel 2.10

Tabel 2. 10 Nilai Level Kekesatan Permukaan Berdasarkan Beberapa Alat Uji

Test Equipment	Test Tyre Tyre Pressure (kPa)	Test Speed (km/h)	Test Depth (mm)	Design Objective For New Surface	Maintenance Planning Level	Minimum Friction Level
Mu-meter trailer	A 70 A 70	65 95	1.0 1.0	0.72 0.66	0.52 0.38	0.42 0.26
Skiddometer trailer	B 210 B 210	65 95	1.0 1.0	0.82 0.74	0.60 0.47	0.50 0.34
Surface friction tester vehicle	B 210 B 210	65 95	1.0 1.0	0.82 0.74	0.60 0.47	0.50 0.34
Runway friction tester vehicle	B 210 B 210	65 95	1.0 1.0	0.82 0.74	0.60 0.54	0.50 0.41
TATRA friction tester vehicle	B 210 B 210	65 95	1.0 1.0	0.76 0.67	0.57 0.52	0.48 0.42
GRIPTESTER trailer	C 140 C 140	65 95	1.0 1.0	0.74 0.64	0.53 0.36	0.43 0.24

(Sumber*:* Dirjen Perhubungan Udara, 2005)

B. Nilai Kekasaran Permukaan Perkerasan (*Roughness*)

Dalam penerapannya, nilai kekasaran permukaan perkerasan biasanya ditentukan oleh parameter yang disebut *International Roughness Index* atau IRI. IRI adalah parameter yang digunakan untuk menentukan tingkat ketidakrataan permukaan jalan. Parameter *Roughness* dipresentasikan dalam suatu skala yang menggambarkan ketidakrataan permukaan perkerasan jalan yang dirasakan pengendara. Ketidakrataan permukaan perkerasan jalan tersebut merupakan fungsi dari potongan memanjang dan melintang permukaan jalan. Disamping factor-faktor tersebut, *roughness* juga dipengaruhi oleh parameter-parameter operasional kendaraan, yang meliputi suspension roda, bentuk kendaraan, kedudukan kerataan kendaraan serta kecepatan.

Wambold,ddk (1981) dalam Arinata (2005) menyampaikan secara umum *Roughness* jalan dapat didefinisikan sebagai deviasi permukaan jalan diukur dari satu bidang datar, ditambah parameter lain yang dapat mempengaruhi hal-hal sebagai berikut : gerakan dinamis kendaraan, kualitas perjalanan, beban dinamis konstruksi serta pengaliran air di permukaan.

International Roughness Index (IRI) digunakan untuk mengukur kekasaran permukaan jalan, kekasaran yang diukur pada setiap lokasi diasumsikan mewakili semua fisik di lokasi tersebut. Kekasaran permukaan jalan adalah nama yang diberikan untuk ketidakrataan memanjang pada permukaan jalan. Ini diukur dengan suatu skala terhadap pengaruh permukaan pada kendaraan yang bergerak di atasnya. Skala yang banyak digunakan di Negara berkembang seperti Indonesia adalah International Roughness Index.

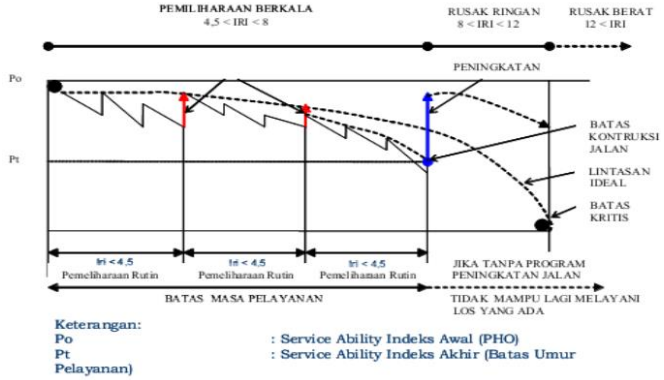
Tingkat kerataan jalan (IRI) ini merupakan salah satu faktor/fungsi pelayanan (functional performance) dari suatu perkerasan jalan yang sangat berpengaruh pada kenyamanan (*riding quality*). Salah satu indikator teknis untuk menilai performansi permukaan jalan adalah nilai IRI (*International Roughness Index*), yaitu besaran ukuran yang mengGambarkan nilai ketidakrataan permukaan yang diindikasikan sebagai panjang kumulatif turun naiknya permukaan per satuan panjang. Kerataan permukaan jalan dianggap sebagai resultante kondisi perkerasan jalan secara menyeluruh. Jika cukup rata maka jalan dianggap baik mulai dari lapis bawah sampai dengan lapis atas perkerasan jalan dan demikian sebaliknya (Hikmat Iskandar 2005 dalam Arinata, 2010).

Nilai IRI dinyatakan dalam meter turun naik per kilometer panjang jalan (m/km). jika nilai IRI = 10 m/km, artinya jumlah amplitude (naik dan turun) permukaan jalan sebesar 10 m dalam tiap km panjang jalan. Semakin besar nilai IRI-nya, maka semakin buruk keadaan permukaan perkerasan. IRI adalah sebuah standar pengukuran kekasaran yang mengacu pada *Response-Type Road Roughness Measurement System (RTRRMS).*

Metode pengukuran kerataan permukaan jalan yang dikenal pada umunya antara lain adalah metode NAASRA (SNI 03-3426-1994). Metode lain yang dapat digunakan untuk pengukuran dan analisis kerataan perkerasan adalah *Rolling Straight Edge, Slope Profilometer/AASHTO Road Test, CHLOE Profilometer,* dan *Roughmeter* (Youder and Witczak, 1975 dalam Arinata dan Surbakti, 2010).

Pada dasarnya penetapan kondisi jalan minimal adalah sedang, dalam Gambar 2.13 terlihat berada pada level IRI antara 4,0 m/km sampai dengan 8 m/km tergantung dari fungsi jalannya.

Jika IRI menunjukkan di bawah 4,0 artinya jalan masih dalam tahap pemeliharaan rutin, sementara jika IRI antara 4,1 sampai 8,0 yang dikategorikan pada kondisi sedang, berarti jalan sudah perlu dilakukan pemeliharaan berkala (*periodic maintenance*) yakni dengan pelapisan ulang (*overlay*). Sedang jika IRI berkisar antara 8 sampai 12, artinya jalan sudah perlu dipertimbangkan untuk peningkatan. Sementara jika IRI > 12 berarti jalan sudah tidak dapat dipertahankan, sehingga langkah yang harus dilakukan adalah rekonstruksi. (Saleh dkk, 2008 dalam Arinata, 2010)



Gambar 2. 13 Hubungan Antara Kondisi, Umur, Dan Jenis Penanganan Jalan
(Sumber: Saleh dkk, 2008)

Direktorat Jenderal Bina Marga menggunakan parameter *International Roughness Index* (IRI) dalam menentukan kondisi konstruksi jalan, yang dibagi atas empat kelompok.Berikut ditampilkan Tabel 2.11 penentuan kondisi ruas jalan dan kebutuhan penanganannya.

Tabel 2. 11 Penentuan Kondisi Jalan dan Kebutuhan Penanganan

Kondisi Jalan	IRI (m/km)	Kebutuhan Penanganan	Tingkat Kemantapan
Baik	IRI rata-rata ≤ 4,0	Pemeliharaan Rutin	Jalan Mantap
Sedang	4,1 ≤ IRI rata-rata ≤ 8,0	Pemeliharaan Berkala	
Rusak Ringan	8,1 ≤ IRI rata-rata ≤ 12	Peningkatan jalan	Jalan Tidak Mantap
Rusak Berat	IRI rata-rata > 12	Peningkatan Jalan	

(Sumber: Direktorat Jendral Bina Marga, 2011)

Sedangkan dalam pelaksanaan di Indonesia yang menjadi acuan dan standar terhadap nilai kekasaran yang digunakan sebagai standar dalam *functional Performance* dari suatu perkerasan khususnya perkerasan bandara adalah nilai IRI < 1.5 mm/m atau 1.7 mm/m yang diuji menggunakan alat Laser Beam Profilometer.

2.6 Holding Bays, Runway-Holding Position, Intermediate Holding Position dan Road-Holding Positions

Dalam suatu bandara dengan fasilitas sisi udara yang kompleks, selain *runway*, *taxiway* dan *apron* biasanya terdapat fasilitas tambahan sebagai sarana penunjang untuk mempercepat proses fase keberangkatan dan fase kedatangan pesawat. Salah satu fasilitas penunjang untuk mempercepat proses keberangkatan adalah fasilitas yaitu *holding bay*. Dalam Cahyaning, 2018 dinyatakan beberapa istilah dalam suatu proses *holding* yaitu sebagai berikut.

a. *Holding Bay* didefinisikan sebagai area di luar *taxiway*, dimana pesawat udara dapat diminta untuk berhenti.
b. *Runway-Holding Position* adalah posisi yang ditetapkan pada *taxiway* untuk memasuki *runway*.

c. *Intermediate Holding-Position* adalah posisi yang ditetapkan pada taxiway selain dari *taxiway* yang menuju ke *runway*.
d. *Road-Holding Position* adalah posisi yang ditetapkan dimana kendaraan menunggu/berhenti sementara sebelum memasuki *runway*.

CASR-139 dalam Cahyaning, 2018 telah menentukan jarak dari *Runway*-Holding Position, Intermediate-Holding Position atau Road-Holding Position ke Runway Centre Line. Adapun jarak tersebut dapat dilihat pada Tabel 2.12.

Tabel 2. 12 Jarak Minimum Dari *Runway*-Holding Position, Intermediate-Holding Position atau Road Holding Position ke Garis Tengah *Runway* yang Berhubungan

Code Number	Jenis *Runway*				
	Non-Instrument	Non-Presicion Approach	Precision Category I	Precision Category II atau III	Lepas Landas
1	30 m	40 m	60 m	-	30 m
2	40 m	40 m	60 m	-	40 m
3	75 m	75 m	90 m [(ab)]	90 m [(ab)]	
4	75 m	75 m	90 m [(abc)]	90 m [(abc)]	

- Untuk p*resicion approach runway* kategori I, II, dan II, jarak dalam Tabel dapat dikurangi sebesar 5 meter untuk setiap meter dimana elevasi holding *runway-holding position* lebih rendah dari elevasi threshold *runway*, asalkan tidak melanggar permukaan transisional dalam.
- Untuk p*resicion approach runway* kategori I, II, dan II, jarak dalam Tabel dapat ditambah guna menghindari *interference* dengan alat bantu radio navigasi khususnya *glide path* dan *localizer facilities.*
- Jarak *runway-holding position* 107,5 m jika *code number* adalah 4F Untuk p*resicion approach* kategori I, II dan III dimana *code Letter* adalah F maka jarak adalah 107,5 m.

(Sumber : CASR 139)

2.7 Mesin Jet dan Bahan Bakar Pesawat

Salah satu karakteristik yang harus dipertimbangkan adalah jenis mesin jet yang digunakan pesawat. Hal ini karena mesin jet yang digunakan oleh masing-masing pesawat berbeda-beda dan berpengaruh terhadap konsumsi bahan bakar, kecepatan, efisiensi dan lama waktu terbang, bahkan jarak tempuh penerbangan. Secara umum, mesin jet pada pesawat terbagi menjadi 2 yaitu *Turbojet Engine* dan *Turbofan Engine*. Mesin pesawat *turbojet* terdiri dari: kompresor, kamar bahan bakar (Combustion-Chamber) dan Turbin di bagian belakang.

Sedangkan mesin Turbo Fan pada dasarnya merupakan merupakan mesin turbo jet yang ditambahkan baling-baling yang biasanya ditempatkan di bagian. Baling-baling ini terbagi menjadi dua jenis yaitu *Single Stage* dan *Multi Stage.* Penambahan kipas ini bertujuan untuk memperbesar *bypass ratio,* perbandingan antara udara yang diteruskan dari pesawat dan yang diserap oleh inti mesin untuk proses pembakaran (*combustion).*

Nilai *bypass ratio* berkaitan erat dengan konsumsi bahan bakar pesawat, yang berpengaruh pada tingkat emisivitas mesin pesawat. Semakin tinggi nilai *bypass ratio,* dalam artian semakin banyak udara yang diteruskan daripada dibakar, maka semakin sedikit bahan bakar yang diperlukan, demikian pula sebaliknya, apabila nilai *bypass ratio* semakin kecil, maka pesawat tersebut membutuhkan bahan bakar yang lebih banyak. (Horonjeff, 2010).

Daya dorong (*thrust*) yang digunakan ketika berada di ketinggian (*Cruising*) adalah 1/5 – 1/4 tenaga yang dipakai ketika lepas landas.Penggunaan bahan bakar dinyatakan dalam satuan berat (Lbs, Kg) per jam per Kg daya dorong, hal ini untuk menghindari kekacauan pengertian akibat kembang susut Volume bahan bakar oleh perubahan temperature, 1 gallon beratnya = 6.8 Lbs = 3.08 Kg ~ 3 Kg.

Spesifikasi penggolongan pesawat berdasarkan mesin yang dipakai oleh masing-masing jenis pesawat, *bypass ratio*, kinerja mesin pesawat dan konsumsi bahan bakar pesawat dapat dilihat pada Tabel 2.13, Tabel 2.14 dan Tabel 2.15.

Tabel 2. 13 Klasifikasi Mesin Pesawat *Turbojet*

Engine Family	Manufacturer	Max. Thrust (lb)	Aircraft
PW610F	Pratt and Whitney	900	Eclipse 500
PW615F	Pratt and Whitney	1,350	Cessna Mustang
PW617F	Pratt and Whitney	1,700	Embraer Phenom 100
JT8D	Pratt and Whitney	21,000	DC-9, MD-80, SUPER 27
PW6000	Pratt and Whitney	24,000	A318
V2500	Pratt and Whitney	32,000	A319, A-320, A-321, MD-90
PW2000	Pratt and Whitney	43,000	B757, C-17, IL-96
JT9D	Pratt and Whitney	56,000	B747, B767, A300, A310, DC-10
PW4000-94	Pratt and Whitney	62,000	B747-400, B767-200/300, MD-11, A300,A310
PW4000-100	Pratt and Whitney	69,000	A300-200, A300-300
GP7000	Pratt and Whitney	70,000	A-380
PW4000-112	Pratt and Whitney	98,000	B777-200, B777-300
RB211-535	Rolls-Royce	43,000	B757-200, B757-300, Tu-204
Trent 500	Rolls-Royce	56,000	A340-500, A340-600
RB211-524	Rolls-Royce	61,000	L-1011, B747-200/400/400/SP/F, B767-300
Trent 700	Rolls-Royce	71,000	A330
Trent 900	Rolls-Royce	76,000	A380
Trent 800	Rolls-Royce	95,000	B777-200, B777-300
CT7	General Electric	2,100	Bell-214ST, Saab 340a
CF34	General Electric	20,000	CRJ-100-200/700/900, ARJ21, EMBRAER 170,175,190
CF6	General Electric	72,000	A300, A310, A330
Genx	General Electric	75,000	B787, B747-800
GE90	General Electric	115,000	B777-200/ER/LR/300ER
CFM56-5B	GE/Imternational Aerospace	33,000	A318, A319, A320, A321
CFM56-3	GE/Imternational Aerospace	24,000	A737-300/400/500
CFM56-2	GE/Imternational Aerospace	24,000	B707, KC-135
CFM56-7B	GE/Imternational Aerospace	27,000	B737-600/700/800/900, BBJ
CFM56-5A	GE/Imternational Aerospace	27,000	A319, A320
CFM56-5C	GE/Imternational Aerospace	34,000	A340-200, A340-300
V2500	International Aerospace	33,000	A319, A320, A321, ACJ, MD-90

(Sumber: *Horonjeff, 2010*)

Tabel 2. 14 Karakteristik Kinerja Mesin Pesawat

Aircraft	Take Off Weight, 1000 lb	Engine	Bypass Ratio	Spesific Fuel Consumption
A340-200	558.9	CFM56-5C	6.4	0.32
B757-200	220	PW2037	6.0	0.33
A-330-300	467	CF6-80E1	5.1	0.33
A320	158.73	CFM56-5A	6.0	0.33
B737-400	138.5	CFM56-3Ca	6.0	0.33
A-310	330.69	PW4152	4.9	0.348
B767-200	315	CF6-80A2	4.7	0.35
B747-400	800	PW4056	4.9	0.359
B737-600	710	CFM56-7B20	5.5	0.36
A321-200	205	V2533-A5	4.6	0.37
BA-146-300	89.5	JT8D-219	5.6	0.406

(Sumber: Horonjeff, 2010)

**Spesific Fuel Consumption* adalah jumlah bahan bakar yang diperlukan untuk menciptakan 1 pound (lbs) dorongan pesawat (*thrust*).

Tabel 2. 15 Konsumsi Bahan Bakar Rerata Pesawat

Aircraft	Engine	Fuel Consumption lb/h	Fuel Consumption per Engine, lb/h
EMB-145	AE3007A	2,253	1,127
A320-200	CFM56-5A3	4,054	2,027
A319-100	CFM56-5A4	6,966	3,483
B737-500	FM56-3B1R	7,879	3,940
B737-200	JT8B-15A	8,829	4,415
B757-200	RB211-535E4B	11,109	5,555
B767-300	CF6-802C2B2F	11,893	5,947
A340-300	CFM56-5C4	16,093	4,023
B747-200	RB211-524D4	28,638	7,160

(Sumber: Horonjeff, 2010)

2.8 Singkatan dan Penamaan Pesawat Menurut Regulasi

Dalam regulasi resmi seperti ICAO dan IATA, terdapat beberapa penamaan yang berhubungan dengan dunia penerbangan. Penamaan dalam regulasi ICAO dan IATA menggunakan kode tersendiri. Kode tersebut digunakan untuk mempersingkat dan membedakan nama bandara, maskapai ataupun jenis pesawat yang digunakan dalam dunia penerbangan. Untuk kode penamaan pesawat sendiri para pakar aviasi sendiri sering menggunakan penamaan dari regulasi ICAO. Sedangkan untuk kode maskapai dan kode bandara yang umum digunakan dan sering dijumpai adalah kode berdasarkan IATA. Dalam Tabel 2.16 merupakan kode yang digunakan ICAO untuk penamaan pesawat sedangkan pada Tabel 2.17 dan 2.18 merupakan tabel kode penamaan untuk beberapa maskapai dan beberapa bandara di Indonesia.

Tabel 2. 16 Kode Penamaan Pesawat Menurut ICAO dan IATA

No	Jenis Pesawat	Kode Penamaan IATA	Kode Penamaan ICAO
1	Antonov AN-24	AN4	AN24
2	Aerospatiale/Alenia ATR 72-600	ATR	AT76
3	British Aerospace 146-100	141	B461
4	Boeing 737-900	739	B739
5	Boeing 777-200 / Boeing 777-200ER	772	B772
6	Boeing 777-300	773	B773
7	Cessna Citation V	CNJ	C560
8	Canadair Regional Jet 700	CR7	CRJ7
9	Douglas DC-9-40	D94	DC94
10	Embraer RJ145	ER4	E145
11	McDonnell Douglas MD-90	M90	MD90
12	Airbus A330-300	333	A333
13	Airbus A350-900	359	A359

(Sumber : ICAO dan IATA, 2018)

Tabel 2. 17 Kode Penamaan Maskapai Menurut IATA dan ICAO

No	Maskapai	Kode Penamaan IATA	Kode Penamaan ICAO
1	Batavia Air	ID	BTK
2	Dirgantara Air Service	AW	DIR
3	Garuda Indonesia	GA	GIA
4	Indonesia AirAsia	QZ	AWZ
5	Lion Mentari Airlines	JT	LNI
6	Merpati Nusantara Airlines	MZ	MNA
7	NAM Air	IN	NIH
8	Sriwijaya Air	XS	SJY
9	Trigana Air Service	UE	TGN
10	Tigerair Mandala	IT	MDL
11	Wings Air	IW	WON
12	Batik Air	ID	BTK

(Sumber : ICAO dan IATA, 2018)

Tabel 2. 18 Kode Penamaan Bandara Menurut IATA dan ICAO

No	Bandara	Lokasi Bandara	Kode Penamaan IATA	Kode Penamaan ICAO
1	Soekarno-Hatta International Airport	Jakarta	CGK	WIII
2	Juanda International Airport	Surabaya	SUB	WARR
3	Kualanamu International Airport	Medan	KNO	WIMM
4	Hang Nadim International Airport	Batam	BTH	WIDD
5	Bandara Ahmad Yani	Semarang	SRG	WAHS
6	Lombok International Airport	Lombok	LOP	WADL
7	Hasanuddin International Airport	Makassar	UPG	WAAA

(Sumber : ICAO dan IATA, 2018)

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BAB III
METODOLOGI

3.1 Umum

Pada perancangan kemiringan holding position dan *exit taxiway* ini diperlukan banyak kajian yang harus ditinjau, untuk itu diperlukan penyusunan metodologi perancangan untuk mengefektifkan waktu dan memperoleh hasil yang sesuai. Sedangkan tujuan yang diharapakan dicapai dari Tugas Akhir ini adalah analisis perancangan kemiringan holding position dan *exit taxiway* yang efektif untuk meningkatkan tingkat keselamatan penerbangan dan optimalisasi penggunaan bahan bakar pada pesawat udara. Metode yang digunakan dalam analisa geometrik kemiringan holding position dan *exit taxiway* dalam perencanaan Bandar Udara ini merujuk pada beberapa literatur. Diharapkan metode yang digunakan dalam evaluasi ini merupakan metode atau pendekatan yang paling mendekati kenyataan, sehigga dapat diperoleh hasil yang akurat.

3.2 Tahap Persiapan

Tahap persiapan merupakan tahap awal sebelum memulai pelaksanan dari sebuah gagasan.Tahap persiapan ini dilakukan beberapa kegiatan sebagai awal dari seluruh rangkaian studi bahan literatur dan studi pendahuluan. Hasil tahapan ini akan sangat mempengaruhi proses yang dilakukan dalam tahap – tahap selanjutnya, karena spesifikasi kebutuhan data, konsep analisa dan sasaran akhir pekerjaan akan ditetapkan dalam tahapan ini.

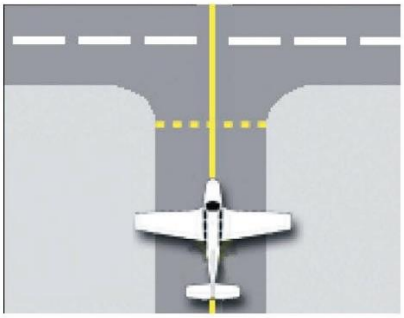
Metode yang digunakan terdiri dari beberapa tahap, yaitu: survei pendahuluan (identifikasi masalah), studi literatur, analisis data, hingga didapatkan hasil dari analisa berupa kesimpulan dan saran. Dari garis besar tersebut dibuatlah kerangka pengerjaan perancangan sebagai berikut:

- Tahap Persiapan
- Tahap Indentifikasi Permasalahan
- Tahap Studi Pustaka (Studi Literatur)
- Tahap Analisa Karakteristik Tipe Pesawat Udara
- Tahap Analisa Faktor Gesekan antara Perkerasan dan Roda Pesawat
- Tahap Analisis dan Perhitungan Kelandaian Holding Position terhadap Kemungkinan terjadinya Sliding
- Tahap Aalisis Konsumsi Bahan Bakar Pesawat terhadap Kemiringan *Exit Taxiway*
- Tahap Penarikan Kesimpulan dan Pemberian Saran

3.3 Tahap Identifikasi Permasalahan

Tahap identifikasi permasalahan merupakan salah satu tahap awal dalam pengerjaan Tugas Akhir ini. Diperlukan identifikasi permasalahan sehingga diperoleh suatu permasalahan yang harus dipecahkan. Dalam peraturan yang ada, yaitu menurut ICAO dan FAA telah diatur kemiringan longitudinal dari *taxiway*, namun dalam perancangan holding position dan *exit taxiway* dengan kondisi kontur tanah eksisting yang tidak ideal dibangun fasilitas sisi udara yang sebidang belum ditentukan kemiringan yang aman agar pesawat tidak mengalami sliding ketika dalam keadaan holding position sebelum memasuki *runway*. Selain itu, untuk permasalahan topografi yang menyebabkan adanya tidak dapat dibangunnya *exit taxiway* yang sebidang dengan apron dan *runway*, maka perlu direncanakan kemiringan yang optimum.

Kemiringan ini perlu direncanakan agar pesawat dapat melintas dengan kecepatan rencana tertentu sehingga didapatkan konsumsi bahan bakar yang paling optimum. Ditunjukkan dalam Gambar 3.1 menunjukkan posisi *holding position* pesawat dan Gambar 3.2 yang merupakan posisi pesawat dalam *exit taxiway* yang merupakan posisi tinjauan dalam perancangan.



Gambar 3. 1 Holding Position Pesawat Sebelum Memasuki *Runway*
(Sumber *: Federal Aviation Administration, 2018*)

Gambar 3. 2 Pesawat dalam Exit Taxiway
(Sumber *:* www.google.com, 2018)

3.4 Studi Pustaka

Tahap studi pustaka ini dilakukan dengan cara mengumpulkan beberapa literatur yang terkait dengan tema ataupun judul pengerjaan Tugas Akhir sebagai referensi pustaka dalam pengerjaan Tugas Akhir ini. Referensi yang digunakan misalnya saja buku, jurnal ilmiah ataupun peraturan terkait perancangan geometrik fasilitas bandara khususnya perancangan fasilitas sisi udara. Berikut ini merupakan beberapa referensi yang akan menjadi acuan dalam perancangan kemiringan holding postion dan *exit taxiway* yang optimum.

a. Merancang, Merencana Lapangan Terbang (Ir. Heru Basuki)
b. Penerbangan dan Bandar Udara (Sakti Adhi Sasmita)
c. Planning and Design of Airport (Horonjeff)
d. Federal Aviation Administration (FAA)
e. International Civil Aviation Organization (ICAO)
f. SKEP 77 Tahun 2005
g. Annex 14-Aerodrome
h. Airport Engineering (Norman J. Ashford)
i. Airplane Characteristic For Airport Planning (Boeing dan Airbus)

3.5 Analisa Karakteristik Tipe Pesawat Udara

Untuk menganalisa kelandaian yang optimum maka diperlukan peninjauan terhadap karakteristik tiap tipe pesawat udara. Karakteristik dan hal-hal teknis tiap tipe pesawat udara ini tercantum dalam katalog pesawat udara terbitan perusahaan produksi pesawat seperti Boeing dan Airbus. Karakteristik yang diambil dalam perancangan kemiringan holding position yang aman pada pesawat serta kemiringan *exit taxiway* yang optimum dalam penggunaan bahan bakar digunakan gaya berat dari pesawat yaitu.

- Operating Weight Empty

  Operating Weight Empty merupakan berat dasar pesawat, termasuk Crew dan peralatan pesawat namun tidak termasuk bahan bakar dan penumpang/barang yang diangkut. Berat ini besarannya tidak tetap tergantung dari tipe pesawat dan konfigurasi tempat duduk.

- Maximum Structural Take Off Weight

  Adalah berat maximum pesawat terbang termasuk didalamnya *crew*, berat pesawat kosong, bahan bakar, pay load yang diizinkan pabrik, sehingga momen tekuk yang terjadi pada badan pesawat terbang, ratarata masih dalam batas kemampuan yang dimiliki oleh material pembentuk pesawat terbang.

- Maximum Ramp Weight

Maximum Ramp Weight merupakan berat maksimum pesawat yang diijinkan untuk *Taxiing.* Pada saat pesawat *taxiing* dari *apron* menuju ke *runway*, pesawat berjalan dengan kemampuannya sendiri, membakar bahan bakar sehingga kehilangan berat. Selisih dan perbedaan maksimum ramp weight ditaksir hingga ratusan kilogram.

3.6 Analisa Faktor Gesekan Perkerasan dan Distribusi Roda Pesawat

Salah satu factor penting dalam perancangan geometric untuk mencegah terjadinya sliding ketika holding position adalah analisa tingkat gaya gesek dari perkerasan eksisting terhadap roda pesawat. Ada beberapa factor yang harus diperhatikan dalam penentuan gaya gesek antara perkerasan dan roda pesawat, factor tersebut antara lain:

1. Kondisi Ban Pesawat
2. Tekanan Ban Pesawat
3. Kekerasan Permukaan Perkerasan
4. Kecepatan Pesawat
5. Keadaan Cuaca

Factor gaya gesek yang paling utama factor gaya gesek dari kekerasan permukaan aspal dan ban pesawat. Faktor gaya gesek dari perkerasan ini diperoleh dari karakteristik perkerasan yang digunakan, misalnya saja 80/R/B/W/T. Dari kode nilai PCN perkerasan tersebut dapat diketahui unsur material dan nilai Pavement Classification Number dari suatu perkerasan.

Berdasarkan pada bab sebelumnya bahwa nilai kekesatan yang akan digunakan adalah sebagai dasar perancangan kemiringan holding position dan *exit taxiway* adalah 0.34 (Nilai Minimum *Skid Resistance* dimana percobaan dengan Alat Skiddometer). Dari nilai kekesatan 0.34 ini kemudian akan digunakan sebagai factor gesekan perkerasan pada bandar udara batu sebagai salah satu variabel akan digunakan dalam menentukan tahanan gelincir pesawat ketika holding.

Selain itu factor gaya gesekan ini juga akan digunakan sebagai variabel dalam menentukan gaya dorong yang dibutuhkan oleh pesawat ketika memasuki *exit taxiway* yang memiliki kemiringan tertentu, yang kemudian gaya dorong tersebut akan dikonversi ke dalam besaran bahan bakar.

Dalam perancangan suatu fasilitas sisi udara dibutuhkanlah beban berat dari pesawat yang kemudian didistribusi ke dalam roda pesawat. Hal ini bertujuan untuk memberikan berat beban yang akan dipukul oleh perkerasan dari fasilitas sisi udara. Mayoritas tipe pesawat menerapkan sistem 95 % beban utama dipikul oleh roda pendaratan utama (*Main Landing Gear)* dan beban lainnya sebesar 5 % dipikul oleh roda depan pesawat (*Nose Landing Gear).*

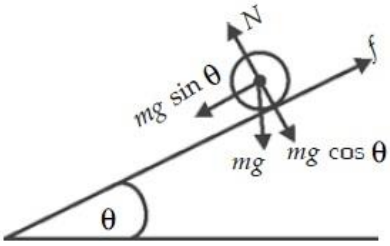
Hal ini juga akan digunakan dalam perancangan kemiringan dari holding position dan *exit taxiway*, dimana dibutuhkan gaya berat yang diberikan pada masing-masing ban pesawat. Dalam menentukan gaya berat pada masing-masing ban pesawat dilakukan dengan membagi berat total pesawat (*Maximum Take Off Weight* untuk perancangan *holding position* dan *Maximum Landing Weight* untuk perancangan *exit taxiway)* yang kemudian didistribusi ke dalam berat roda pendaratan utama dan berat roda depan dengan persentase 95 % dan 5 %. Dari hasil distribusi roda pendaratan utama dan roda depan tersebut kemudian dilakukan distribusi lagi ke masing-masing roda dengan membagi berat total yang telah distribusi dengan jumlah roda.

3.7 Analisis dan Perhitungan Kelandaian Holding Position terhadap Kemungkinan Terjadinya Sliding

Setelah didapatkan karakteristik dan hal-hal teknis pesawat udara yang berkenaan dengan perencanaan geometrik fasilitas sisi udara, terutama kelandaian *taxiway*, maka dilakukan analisis dan perhitungan kemiringan *taxiway* yang ideal untuk setiap tipe pesawat udara. Analisis dan perhitungan ini dilakukan dengan metode trial and error untuk setiap kelandaian yang berbeda-beda untuk tiap tipe pesawat udara sehingga diperoleh nilai kelandaian yang paling ideal. Dasaran yang digunakan untuk menganalis kemungkinan terjadinya sliding ketika holding position ini adalah dengan prinsip fisika bidang miring dimana terdapat gaya *friction* dan gaya berat dari pesawat sebagai variabel utama.

Konsep bidang miring menekankan terhadap analisa gaya berat dari pesawat yang dapat mengalami sliding dengan sudut kemiringan tertentu, yang berlawanan dengan gaya gesek kinetis antara permukaan perkerasan dengan ban pesawat ketika memasuki *holding position* dengan kecepatan tertentu yang kemudian berhenti untuk menunggu antrian penggunaan *runway*. Analisa ini mensimulasikan bidang miring dengan persentase atau sudut kemiringan tertentu dengan gaya berat sendiri pesawat ketika melakukan *holding* yang sudah terdistribusi ke dalam roda yang kemudian diperhitungkan melawan gaya gesek dari perkerasan. Adapun hukum dan konsep dasar perancangan yaitu bidang miring di ilustrasikan dalam Gambar 3.3.

Jika gaya gesek yang terjadi lebih besar dari gaya *sliding* akibat berat sendiri pesawat, maka dapat dikatakan pesawat akan mengalami *sliding* dan tergelincir memasuki *runway*. Ketentuan pesawat yang digunakan sebagai dasar acuan perancangan adalah *Maximum Take off Weight* dari suatu pesawat. Alasannya ialah, karena *Maximum Take off Weight* merupakan berat pendekatan yang paling ideal ketika pesawat dalam posisi *holding* sebelum memasuki *runway*.



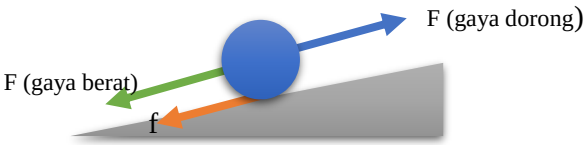
Gambar 3. 3 Konsep Fisika Bidang Miring
*(*Sumber *: www.fisikazone.com, 2018)*

3.8 Analisis Konsumsi Bahan Bakar terhadap Kemiringan Exit Taxiway

Tahapan ini adalah suatu tahapan untuk mengoreksi nilai kelandaian yang telah didapatkan dari proses trial and error pada tahapan sebelumnya dengan meninjau konsumsi bahan bakar pada pesawat ketika dalam keadaan *Taxiing.* Kelandaian *exit taxiway* yang paling optimum adalah keadaan dimana kelandaian yang diperoleh aman terhadap kemungkinan terjadinya sliding pada pesawat udara dan memiliki tingkat konsumsi bahan bakar yang paling efisien. Konsumsi bahan bakar oleh mesin pesawat dinyatakan dalam satuan berat (lb) per gaya dorong. Analisa ini dilakukan melalui simulasi kemiringan tertentu yang direncanakan sehingga pesawat yang memasuki *taxiway* dapat *taxiing* dengan kecepatan yang yang telah ditetapkan dalam peraturan. Kecepatan yang digunakan dalam perancangan kemiringan ini yaitu 10-20 knot (5,2 m/s – 10, 3 m/s) dimana kecepatan tersebut merupakan kecepatan maksimum pesawat ketika dalam keadaan *taxiing.*

Kemudian analisa selanjutnya dilakukan dengan melakukan simulasi kemiringan tertentu dengan meninjau factor gesekan, gaya berat pesawat, dan gaya dorong yang dihasilkan oleh pesawat. Gaya berat yang digunakan dalam perancangan yang digunakan dalam perancangan ini adalah merupakan berat maksimal lepas landas (*Maximum Landing Weight).* Sedangkan analisa penggunaan bahan bakar direpresentasikan sebagai gaya dorong yang dibutuhkan pesawat tersebut untuk memasuki *exit taxiway* dengan kemiringan tertentu dengan mengaplikasikan gaya perlawanan terhadap gaya dorong yaitu gaya gesek dan gaya berat pesawat.

Gaya dorong tersebut kemudian akan dibandingkan dengan gaya dorong pada *exit taxiway* yang sebidang dengan meninjau *Spesific Fuel Consumpstion* pada Tabel 2.14 pada bab sebelumnya. Skema ilustrasi dasar yang digunakan dalam perancangan gradien *taxiway* ini disajikan dalam Gambar 3.4.

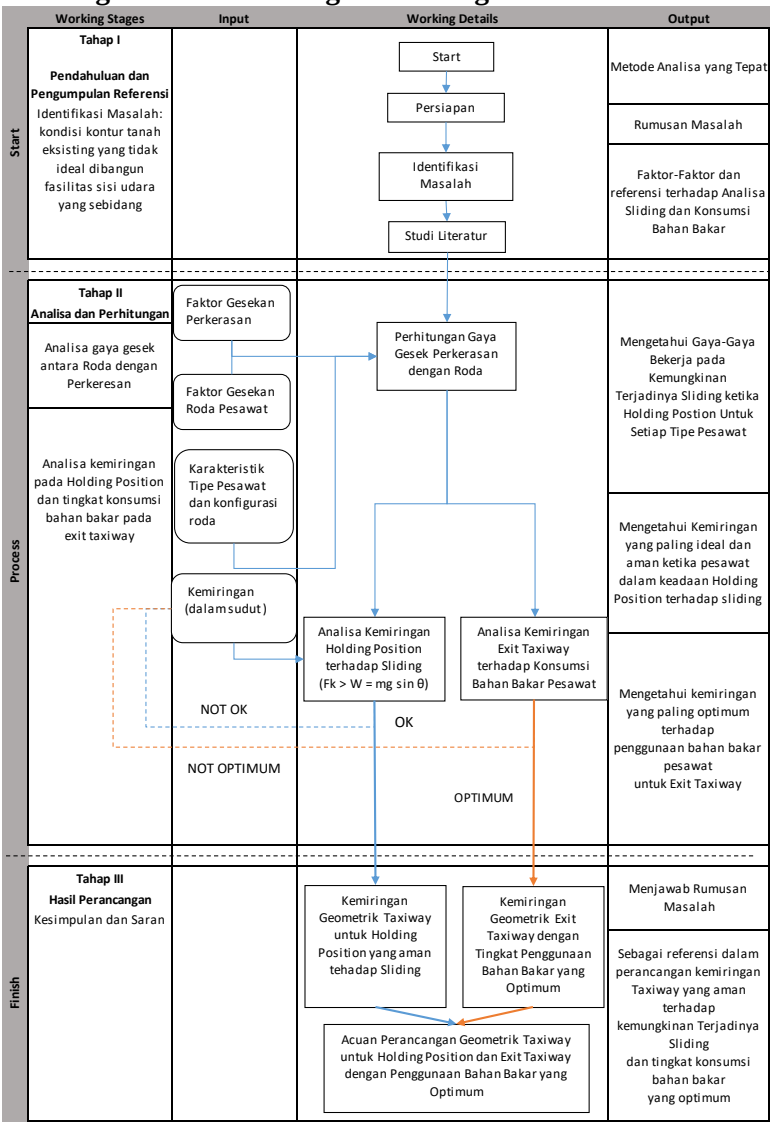


Gambar 3. 4 Ilustasi Perancangan Kemiringan Exit Taxiway

3.9 Kesimpulan dan Saran

Pada tahap ini berdasarkan perhitungan yang dilakukan bisa ditarik kesimpulan yang berupa perancangan geometrik, terutama kemiringan *taxiway* ketika holding position yang paling ideal untuk meningkatkan keselamatan penerbangan, serta kemiringan *exit taxiway* yang paling ideal penerbangan yang ditinjau dengan tingkat konsumsi bahan bakar yang paling efisien. Selain itu memberikan referensi untuk pengembagan ataupun pelaksana proyek bandar udara dalam pelaksanaan pekerjaan yang memilki kasus sejenis.

3.10 Bagan Alir Metodologi Perancangan



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BAB IV
ANALISIS DAN PERHITUNGAN

4.1 Analisis Distribusi Gaya Yang Bekerja Pada Roda Pesawat

Dalam perancangan kemiringan yang ideal dari *holding position* dibutuhkan analisis terhadap distibusi gaya yang bekerja pada tiap roda pesawat yang akan direncanakan beroperasi pada bandara yang dilakukan perancangan. Dibutuhkan beberapa spesifikasi teknis yang akan digunakan dalam analisis distribusi tersebut antara lain *Maximum Take Off Weight*, prosentase distribusi berat pesawat pada *Main Landing Gear* dan *Nose Gear*, serta jumlah Gandar dan roda tiap gandar.

4.1.1 Maximum Take Off Weight

Maximum Take Off Weight merupakan bobot yang digunakan dalam perancangan kemiringan dari *holding position taxiway* karena merupakan representasi bobot paling mendekati ketika pesawat melakukan *holding position* yang berikutnya akan memasuki *runway* dan melakukan lepas landas. Nilai *maximum take off weight* diperoleh dari *characteristic for airport planning manual* dari masing-masing pesawat. Contohnya dapat kita lihat *maximum take off weight* untuk pesawat Boeing 737-900ER pada Tabel 4.1 yang diperoleh dari *characteristic for airport planning manual* dari pesawat Boeing 737 Series.

Tabel 4. 1 Maximum Take Off Weight Boeing 737-900ER

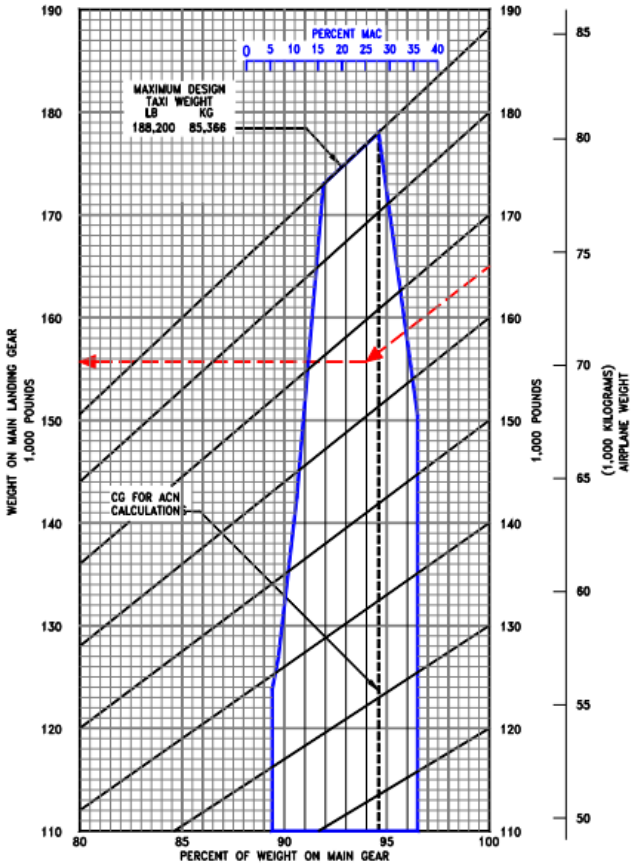
CHARACTERISTICS	UNITS	MODEL 737-900ER, -900ER WITH WINGLETS		
MAX DESIGN TAXI WEIGHT	POUNDS	164,500		188,200
	KILOGRAMS	74,616		85,366
MAX DESIGN TAKEOFF WEIGHT	POUNDS	164,000		187,700
	KILOGRAMS	74,389		85,139
MAX DESIGN LANDING WEIGHT	POUNDS	146,300		157,300
	KILOGRAMS	66,361		71,350
MAX DESIGN ZERO FUEL WEIGHT	POUNDS	138,300		149,300
	KILOGRAMS	62,732		67,721
OPERATING EMPTY WEIGHT (1)	POUNDS	98,495		98,495
	KILOGRAMS	44,677		44,677
MAX STRUCTURAL PAYLOAD	POUNDS	39,308		50,805
	KILOGRAMS	17,830		23,045
SEATING CAPACITY (1)	TWO-CLASS	177		177
	ALL-ECONOMY	186 WITH MID EXIT DOOR, 215: FAA EXIT LIMIT		
AUXILIARY FUEL OPTIONS	SEE NOTES	(2)	(3)	(4)
MAX CARGO - LOWER DECK	CUBIC FEET	1,826	1,676	1,587
	CUBIC METERS	51.7	47.5	44.9
USABLE FUEL	US GALLONS	6,875	7,390	7,837
	LITERS	26,025	27,974	29,666
	POUNDS	46,063	49,513	52,508
	KILOGRAMS	20,894	22,459	23,817

(Sumber: Airport Planning Manual Boeing 737 Series, 2018)

Dari Tabel 4.1 dapat diambil nilai *Maximum Take Off Weight* yang paling kritis adalah *Maximum Take Off Weight* terbesar yaitu **187.700 pon** atau **85.139 kg**.

4.1.2 Prosentase distribusi Berat Pesawat pada *Main Landing Gear* dan *Nose Gear*

Dalam perancangan kemiringan *holding position* ini akan ditinjau gandar utama pendaratan (*Main Landing Gear*) dari pesawat karena merupakan gandar yang paling menentukan dan merupakan gandar paling kritis karena memiliki distribusi berat pesawat yang terbesar. Nilai prosentase distribusi antara *main landing gear* dan *nose gear* umumnya mempunyai nilai 95 % untuk *landing gear* dan 5 % untuk *nose gear*. Namun, pada dasarnya nilai prosentase distribusi antara *main landing gear* dan *nose gear* memiliki perbedaan pada tiap pesawat tergantung dari tipe dan seri dari pesawat tersebut. Dalam perancangan kemiringan *holding position* ini digunakan nilai distibusi yang berbeda-beda tergantung dari tipe pesawat sehingga dapat diperoleh angka yang lebih spesifik. Nilai prosentase distibusi ini diperoleh dari *airport planning manual* untuk setiap tipe pesawat. Contohnya prosentase distibusi untuk pesawat Boeing 737-900ER dapat dilihat pada Gambar 4.1 yang diperoleh dari *characteristic for airport planning manual* dari pesawat Boeing 737 Series.

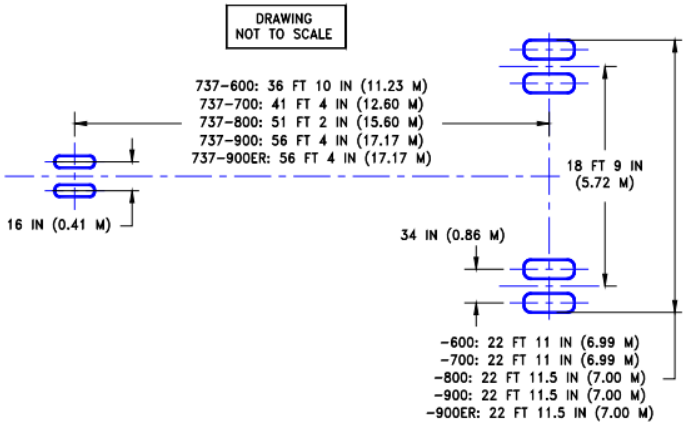


Gambar 4. 1 Grafik Distribusi Berat Boeing 737-900ER
(Sumber: Airport Planning Manual Boeing 737, 2018)

Dari Gambar 4.1 dapat diambil nilai distribusi pada *main landing gear* adalah sebesar **94,7 %** dari keseluruhan berat pesawat yang nantinya akan digunakan sebagai prosentase dasar untuk perancangan.

4.1.3 Jumlah Gadar dan Roda Tiap Gandar

Dalam perancangan *holding position* ini akan diperhitungkan gaya yang dialami tiap roda pesawat pada *main landing gear* oleh karena itu dibutuhkan pula data mengenai jumlah gandar dan jumlah roda pesawat yang beroperasi pada *main landing gear*. Data mengenai jumlah ini diperoleh dari *characteristic for airport planning manual* pada tiap tipe pesawat. Adapun contoh dari jumlah gandar dan roda untuk pesawat Boeing 737-900ER dapat dilihat pada Gambar 4.2 yang diperoleh dari *characteristic for airport planning manual* dari pesawat Boeing 737 Series.



Gambar 4. 2 Jumlah Gandar dan Roda Boeing 737-900ER
(Sumber: Airport Planning Manual Boeing 737, 2018)

Dari Gmbarl 4.2 dapat dilihat jumlah gandar pada *main landing gear* adalah sebanyak 2 buah gandar kiri dan kanan dimana tiap gandar memiliki 2 buah roda.

4.1.4 Perhitungan Gaya Berat Pada Tiap Roda Pesawat

Dalam perancangan *holding position* ini akan diperhitungkan gaya yang dialami tiap roda pesawat pada *main landing gear*. Perhitungan tersebut menggunakan metode empiris dimana bobot pesawat berdasarkan MTOW dikali dengan prosentase distribusi tehadap *main landing gear* pesawat kemudian dibagi dengan jumlah gandar dan jumlah roda pesawat pada *main landing gear*. Adapun rumusan perhitungan gaya berat yang bekerja pada tiap roda pada *main landing gear* dirumuskan sebagai berikut.

$$m_{tire} = \frac{W_{mtow} \cdot \%_{wd}}{n_{gear} \cdot n_{tire}} \qquad (4.1)$$

Dimana:

m_{tire} = gaya berat yang diterima roda (kg/lb)
m_{mtow} = bobot Max. Take Off Weight (kg/lb)
$\%_{wd}$ = prosentase distribusi berat gandar utama
n_{gear} = jumlah gandar utama
n_{tire} = jumlah roda pada tiap gandar

Berikut contoh perhitungan gaya berat yang diterima roda pada gandar utama untuk pesawat Boeing 737-900ER:

Data diketahui:

m_{mtow} = 187.700 lb atau 85.139 kg
$\%_{wd}$ = 94,7 %
n_{gear} = 2 buah
n_{tire} = 2 buah

$$m_{tire} = \frac{85.139x\ 94{,}7\ \%}{2\ x\ 2} = 20156{,}658\ kg$$

Menggunakan perhitungan dengan cara yang sama maka diperoleh hasil perhitungan untuk gaya berat yang diterima oleh tiap roda pada gandar utama untuk setiap tipe pesawat. Rekapitulasi hasil perhitungan gaya berat yang diterima tiap roda untuk beberapa tipe pesawat dapat dilihat pada Tabel 4.2.

Tabel 4. 2 Rekapitulasi Perhitungan Gaya Berat Tiap Roda Untuk Beberapa tipe Pesawat

No	Jenis Pesawat	MTOW (kg)	Prosentase Gandar Utama (%)	n Gandar	n Roda	Gaya Berat pada tiap Roda (kg)
1	ATR 42	18600	95	2	2	4417,5
2	ATR 72	22800	95	2	2	5415
3	DC-9-15	41141	93	2	2	9565,2825
4	DC-10-40	251744	95	2	4	29894,6
5	MD-11	273294	95	2	4	32453,6625
6	B739ER	85139	94,7	2	2	20156,658
7	B748	447696	94,7	4	4	26498,01
8	B753	122470	92,7	2	4	14191.211
9	B773ER	351535	92,4	2	6	27068,195
10	A339	242000	93,9	2	4	28404,75
11	A359	280000	93,1	2	4	32585
12	A388	575000	94,3	4	6	22592,71

Dari perhitungan gaya berat tiap roda yang terdistribusi ini diperoleh nilai paling kritis dari tiap tipe pesawat yaitu pesawat Airbus 350-900 (A359) dengan berat pesawat yang terdistribusi ke tiap roda adalah 32585 kg. Angka gaya berat ini kemudian akan digunakan sebagai dasar analisa dan perhitungan terhadap sliding dengan gradien tertentu yang disajikan pada pembahasan selanjutnya.

4.2 Analisis Kemiringan Holding Position terhadap Kemungkinan Tergelincir Akibat Berat Sendiri Memasuki Runway

Perancangan kemiringan holding position dilakukan dengan menganalisa tingkat tahanan gaya yang bekerja pada roda pesawat. Tahanan gaya ini merupakan akibat dari skid resistance dari perkerasan *holding taxiway*. Tahanan gaya ini kemudian akan di bandingkan dengan gaya berat pesawat sebagai suatu gaya dorong terhadap kemungkinan terjadinya gelincir ketika pesawat sudah dalam keadaan benar-benar berhenti. Dalam hal ini digunakan beberapa nilai kemiringan dalam satuan deraja hingga diperoleh nilai kemiringan kritis dimana gaya tahanan akibat skid resistance aspal tidak lagi mampu menahan gaya berat pesawat.

4.2.1 Variabel Perancangan

a. Gaya Berat Pada Pesawat Terdistribusi

Sama seperti pada pembahasan sebelumnya perancangan kemiringan pada bagian *holding position* mengacu terhadap gaya yang bekerja pada komponen roda pesawat. Salah satu gaya yang bekerja tersebut merupakan gaya berat pesawat itu sendiri. Gaya berat yang digunakan disini diambil dari berat lepas landas maksimum yang merupakan representasi dari berat pesawat ketika dalam keadaan *holding* sebelum memasuki *runway*. Gaya berat disini kemudian di distribusikan ke bagian roda, yaitu bagian roda yang digunakan sebagai roda pendaratan utama dimana nilai dan cara distribusi ini telah dijelaskan pada sub-bab sebelumnya.

b. Kecepatan Taxiing

Berdasarkan literatur yang terdapat pada bab 2 khususnya point 2.4.2 mengenai kecepatan pesawat di *taxiway* telah ditetapkan kecepatan pesawat dalam keadaan *taxiing*. Kecepatan pesawat ketika *taxiing* berkisar antara 5 hingga 20 knots (9 hingga 37 km/jam, 6 hingga 23 mil/jam atau setara dengan 2,6 hingga 10,3 m/s). Akan tetapi karena pada keadaan holding, kondisi pesawat benar-benar berhenti secara keseluruhan atau dengan kata lain tidak memiliki kecepatan. Maka dalam perancangan kemiringan ini pesawat dianggap berhenti total dengan kecepatan 0 m/s.

c. Gaya Gravitasi

Dalam perancangan kemiringan holding position ini gaya gravitasi juga berpengaruh terhadap besaran gaya dari berat pesawat. Dalam perancangan ini digunakan ketetapan percepatan gravitasi yaitu 9,81 m/s^2.

d. Skid Resistance

Skid Resistance merupakan nilai gesekan yang terjadi antara permukaan perkerasan dan roda kendaraan. Skid resistance disini akan memberi pengaruh terhadap gaya tahanan yang bekerja pada roda pesawat. Gaya tahanan ini yang nantinya akan melawan gaya berat yang mendorong pesawat kearah *runway*. Dalam perancangan ini digunakan nilai skid resistance berdasarkan ketetapan yang sudah yaitu berdasarkan Annex 14, Aerodromes dan SKEP 76/VI/2005 tentang Petunjuk Pelaksana Keputusan Menteri Perhubungan Nomor 47 Tahun 2002 Tentang Sertifikasi Operasi Bandar Udara yang ditunjukkan dalam Tabel 4.3.

Tabel 4. 3 Nilai Level Kekesatan Permukaan Berdasarkan Beberapa Alat Uji

Test Equipment	Test Tyre Tyre Pressure (kPa)	Test Speed (km/h)	Test Depth (mm)	Design Objective For New Surface	Maintenance Planning Level	Minimum Friction Level
Mu-meter trailer	A 70 A 70	65 95	1.0 1.0	0.72 0.66	0.52 0.38	0.42 0.26
Skiddometer trailer	B 210 B 210	65 95	1.0 1.0	0.82 0.74	0.60 0.47	0.50 0.34
Surface friction tester vehicle	B 210 B 210	65 95	1.0 1.0	0.82 0.74	0.60 0.47	0.50 0.34
Runway friction tester vehicle	B 210 B 210	65 95	1.0 1.0	0.82 0.74	0.60 0.54	0.50 0.41
TATRA friction tester vehicle	B 210 B 210	65 95	1.0 1.0	0.76 0.67	0.57 0.52	0.48 0.42
GRIPTESTER trailer	C 140 C 140	65 95	1.0 1.0	0.74 0.64	0.53 0.36	0.43 0.24

(Sumber*:* Dirjen Perhubungan Udara, 2005)

Telah ditetapkan pada bab sebelumnya bahwa nilai skid resistance level yang akan digunakan pada perancangan kemiringan holding ini adalah **0,34** yang merupakan nilai *minimum friction level* dengan menggunakan Skiddometer. Digunakan Skiddometer karena merupakan alat untuk menguji skid resistance yang terdapat di bandara-bandara yang ada di Indonesia. Salah satu bandara yang telah menggunakan skiddometer sebagai alat pengukur nilai *friction level* dari perkerasan adalah Bandara Soekarno-Hatta.

e. Gradien Kemiringan

Gradien kemiringan disini merupakan variabel utama yang akan direncanakan. Gradien kemiringan ini akan diubah-ubah \hingga memperoleh kemiringan yang optimum. Dalam perancangan, pada awalnya akan dianalisis nilai kemiringan kritis terhadap kemungkinan terjadinya gelincir. Nilai gradien kemiringan ini akan dinyatakan dalam satuan derajat kemiringan.

4.2.2 Perhitungan Kemiringan Kritis

Dasar perancangan dalam menentukan gradien yang optimum dari holding position digunakan simulasi berdasarkan prinsip fisika bidang miring. Perhitungan kemiringan dari holding position didasarkan berdasarkan prinsip Hukum Newton I yang diaplikasikan pada bidang miring yaitu dalam perencanaan ini merupakan *holding taxiway* dengan kemiringan tertentu yang dinyatakan dengan besaran derajat. Berdasarkan Hukum Newton I maka dasar perancangan gradien untuk holding position dirumuskan sebagai berikut.

$$\Sigma F = 0 \quad (4.2)$$

$$mg.\sin\theta - mg.cos\,\theta.\mu = 0 \quad (4.3)$$

Dengan menggunakan dasar perumusan dari rumus (4.3) maka akan dihitung nilai resultan gaya yang terjadi, jika nilai resultan gaya bernilai lebih besar dari 0 ($R \geq 0$) maka dapat dikatakan bahwa gradien rencana yang digunakan masih aman terhadap kemungkinan terjadinya gelincir. Sedangkan jika nilai resultan gaya yang terjadi akibat gradien rencana kurang dari 0 ($R < 0$) maka dapat disimpulkan bahwa pesawat akan tergelincir memasuki *runway*. Dari pernyataan tersebut maka dapat dirumuskan suatu rumusan sebagai berikut.

$$R = mg.cos\,\theta.\mu - mg.\sin\theta \qquad (4.4)$$

dimana:

R = Resultan gaya yang bekerja (N)
m = berat yang diterima tiap roda (kg)
g = percepatan gravitasi = 9,81 (m/s^2)
θ = kemiringan (°)

Dengan menggunakan (4.4) kemudian dihitung nilai resultan gaya yang terjadi dari gaya dorong akibat berat pesawat dengan gaya tahanan akibat *skid resistance* perkerasan *taxiway*. Berikut merupakan contoh perhitungan dari resultan gaya dari gaya dorong dan gaya tahanan dari suatu roda pesawat, dalam contoh perhitungan ini digunakan tipe pesawat Boeing 737-900ER.

a. Kemiringan 1°(g = 1,8 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 1°

$$R = mg.cos\ \theta.\mu - mg.\sin\theta$$

$$R = 20156{,}658.9.81\cos 1°.0.34 - 20156{,}658.9.81\sin 1°$$
$$= 63769{,}1\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 1° dapat dilihat dalam Tabel 4.4.

Tabel 4. 4 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 1°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14731,88	756,31	13975,573
2	ATR 72	5415	18058,440	927,091	17131,348
3	DC-9-15	9565,2825	31899,184	1637,65	30261,5302
4	DC-10-40	29894,6	99695.262	5118.198	94577.064
5	MD-11	32453,6625	108229.459	5556.330	102673.129
6	B739ER	20156,658	67220.278	3450.983	63769.295
7	B748	26498,01	88367.991	4536.673	83831.318
8	B753	14191.211	47326.157	2429.650	44896.506
9	B773ER	27068,195	90269.507	4634.294	85635.213
10	A339	28404,75	94726.774	4863.123	89863.650
11	A359	32585	108667.456	5578.816	103088.640
12	A388	22592,71	75344.242	3868.055	71476.188

b. Kemiringan 2°(g = 3,5 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 2°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$
$$R = 20156{,}658.9.81\cos 2°.0.34 - 20156{,}658.9.81\sin 2°$$
$$= 60288{,}648\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 2° dapat dilihat dalam Tabel 4.5.

Tabel 4. 5 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 2°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14725.154	1512.393	13212.761
2	ATR 72	5415	18050.189	1853.901	16196.287
3	DC-9-15	9565,2825	31884.608	3274.809	28609.799
4	DC-10-40	29894,6	99649.708	10234.837	89414.871
5	MD-11	32453,6625	108180.005	11110.968	97069.038
6	B739ER	20156,658	67189.563	6900.915	60288.648
7	B748	26498,01	88327.613	9071.965	79255.648
8	B753	14191.211	47304.532	4858.561	42445.971
9	B773ER	27068,195	90228.259	9267.177	80961.082
10	A339	28404,75	94683.489	9724.766	84958.724
11	A359	32585	108617.802	11155.933	97461.869
12	A388	22592,71	75309.815	7734.931	67574.883

c. Kemiringan 3°(g = 5 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 3°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$
$$R = 20156{,}658.9.81\cos 3°.0.34 - 20156{,}658.9.81\sin 3°$$
$$= 56789{,}64\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 3° dapat dilihat dalam Tabel 4.6.

Tabel 4. 6 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 3°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14713.936	2268.014	12445.92
2	ATR 72	5415	18036.438	2780.146	15256.29
3	DC-9-15	9565,2825	31860.319	4910.9665	26949.35
4	DC-10-40	29894,6	99573.799	15348.357	84225.44
5	MD-11	32453,6625	108097.598	16662.220	91435.38
6	B739ER	20156,658	67138.38084	10348.745	56789.64
7	B748	26498,01	88260.32884	13604.493	74655.84
8	B753	14191.211	47268.49727	7285.9910	39982.51
9	B773ER	27068,195	90159.52754	13897.237	76262.29
10	A339	28404,75	94611.36362	14583.445	80027.92
11	A359	32585	108535.0613	16729.651	91805.41
12	A388	22592,71	75252.44698	11599.451	63653

d. Kemiringan 4° (g = 7 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 4°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$
$$R = 20156{,}658.9.81\cos 4°.0.34 - 20156{,}658.9.81\sin 4°$$
$$= 53273.325\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 4° dapat dilihat dalam Tabel 4.7.

Tabel 4. 7 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 4°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14698.238	3022.944	11675.294
2	ATR 72	5415	18017.195	3705.544	14311.651
3	DC-9-15	9565,2825	31826.327	6545.628	25280.699
4	DC-10-40	29894,6	99467.559	20457.204	79010.355
5	MD-11	32453,6625	107982.264	22208.398	85773.866
6	B739ER	20156,658	67066.748	13793.423	53273.325
7	B748	26498,01	88166.160	18132.878	70033.282
8	B753	14191.211	47218.064	9711.202	37506.862
9	B773ER	27068,195	90063.332	18523.064	71540.268
10	A339	28404,75	94510.418	19437.683	75072.735
11	A359	32585	108419.260	22298.274	86120.986
12	A388	22592,71	75172.157	15460.439	59711.718

e.

f. Kemiringan 5° (g = 8,75 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 5°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$
$$R = 20156{,}658.9.81\cos 5°.0.34 - 20156{,}658.9.81\sin 5°$$
$$= 49740.786\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 5° dapat dilihat dalam Tabel 4.8.

Tabel 4. 8 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 5°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14678.062	3776.953	10901.109
2	ATR 72	5415	17992.463	4629.813	13362.649
3	DC-9-15	9565,2825	31782.639	8178.296	23604.343
4	DC-10-40	29894,6	99331.020	25559.818	73771.202
5	MD-11	32453,6625	107834.037	27747.811	80086.226
6	B739ER	20156,658	66974.686	17233.899	49740.786
7	B748	26498,01	88045.134	22655.739	65389.396
8	B753	14191.211	47153.248	12133.455	35019.793
9	B773ER	27068,195	89939.703	23143.248	66796.454
10	A339	28404,75	94380.684	24286.000	70094.684
11	A359	32585	108270.434	27860.104	80410.329
12	A388	22592,71	75068.968	19316.717	55752.251

g. Kemiringan 6° (g = 10,5 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 6°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$

$$R = 20156{,}658.9.81\cos 6°.0.34 - 20156{,}658.9.81\sin 6°$$
$$= 46193.096\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 1° dapat dilihat dalam Tabel 4.9.

Tabel 4. 9 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 6°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14653.414	4529.812	10123.603
2	ATR 72	5415	17962.250	5552.672	12409.578
3	DC-9-15	9565,2825	31729.270	9808.472	21920.797
4	DC-10-40	29894,6	99164.225	30654.647	68509.578
5	MD-11	32453,6625	107652.963	33278.772	74374.192
6	B739ER	20156,658	66862.222	20669.126	46193.096
7	B748	26498,01	87897.290	27171.698	60725.591
8	B753	14191.211	47074.069	14552.012	32522.057
9	B773ER	27068,195	89788.676	27756.383	62032.294
10	A339	28404,75	94222.201	29126.919	65095.282
11	A359	32585	108088.627	33413.448	74675.178
12	A388	22592,71	74942.913	23167.110	51775.802

h. Kemiringan 7° (g = 12 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 7°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$
$$R = 20156{,}658.9.81\cos 7°.0.34 - 20156{,}658.9.81\sin 7°$$
$$= 42631{,}336\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 7° dapat dilihat dalam Tabel 4.10.

Tabel 4. 10 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 7°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14624.304	5281.290	9343.013
2	ATR 72	5415	17926.566	6473.840	11452.726
3	DC-9-15	9565,2825	31666.235	11435.661	20230.574
4	DC-10-40	29894,6	98967.222	35740.138	63227.084
5	MD-11	32453,6625	107439.097	38799.595	68639.502
6	B739ER	20156,658	66729.392	24098.056	42631.336
7	B748	26498,01	87722.671	31679.381	56043.289
8	B753	14191.211	46980.550	16966.136	30014.414
9	B773ER	27068,195	89610.300	32361.063	57249.237
10	A339	28404,75	94035.017	33958.965	60076.051
11	A359	32585	107873.895	38956.614	68917.281
12	A388	22592,71	74794.029	27010.447	47783.582

i. Kemiringan 8° (g = 14 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 8°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$
$$R = 20156{,}658.9.81\cos 8°.0.34 - 20156{,}658.9.81\sin 8°$$
$$= 35826.689\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 8° dapat dilihat dalam Tabel 4.11.

Tabel 4. 11 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 8°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14590.738	6031.160	8559.578
2	ATR 72	5415	17885.421	7393.035	10492.386
3	DC-9-15	9565,2825	31593.555	13059.367	18534.189
4	DC-10-40	29894,6	98740.074	40814.742	57925.331
5	MD-11	32453,6625	107192.504	44308.600	62883.904
6	B739ER	20156,658	61070.517	25243.828	35826.689
7	B748	26498,01	87521.330	36177.414	51343.916
8	B753	14191.211	46872.721	19375.092	27497.629
9	B773ER	27068,195	89404.627	36955.885	52448.742
10	A339	28404,75	93819.188	38780.668	55038.521
11	A359	32585	107626.304	44487.913	63138.390
12	A388	22592,71	74622.363	30845.556	43776.806

j. Kemiringan 9° (g = 15,8 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 9°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$
$$R = 20156{,}658.9.81\cos 9°.0.34 - 20156{,}658.9.81\sin 9°$$
$$= 35469.945\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 9° dapat dilihat dalam Tabel 4.12.

Tabel 4. 12 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 9°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14552.728	6779.193	7773.535
2	ATR 72	5415	17838.828	8309.979	9528.849
3	DC-9-15	9565,2825	31511.252	14679.094	16832.158
4	DC-10-40	29894,6	98482.848	45876.914	52605.934
5	MD-11	32453,6625	106913.259	49804.108	57109.151
6	B739ER	20156,658	66402.799	30932.853	35469.945
7	B748	26498,01	87293.330	40664.427	46628.903
8	B753	14191.211	46750.614	21778.146	24972.467
9	B773ER	27068,195	89171.721	41539.450	47632.271
10	A339	28404,75	93574.782	43590.557	49984.225
11	A359	32585	107345.928	50005.661	57340.267
12	A388	22592,71	74427.965	34671.270	39756.696

k. Kemiringan 10° (g = 17,6 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 10°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$

$$R = 20156{,}658.9.81\cos 10°.0.34 - 20156{,}658.9.81\sin 10°$$
$$= 31872.497\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 10° dapat dilihat dalam Tabel 4.13.

Tabel 4. 13 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 10°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14510.285	7525.161	6985.124
2	ATR 72	5415	17786.801	9224.391	8562.410
3	DC-9-15	9565,2825	31419.349	16294.350	15124.999
4	DC-10-40	29894,6	98195.623	50925.111	47270.512
5	MD-11	32453,6625	106601.447	55284.445	51317.002
6	B739ER	20156,658	66209.135	34336.638	31872.497
7	B748	26498,01	87038.740	45139.053	41899.686
8	B753	14191.211	46614.266	24174.567	22439.699
9	B773ER	27068,195	88911.652	46110.362	42801.290
10	A339	28404,75	93301.871	48387.168	44914.703
11	A359	32585	107032.855	55508.177	51524.678
12	A388	22592,71	74210.897	38486.422	35724.475

l. Kemiringan 11° (g = 19,4 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 11°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$
$$R = 20156{,}658.9.81\cos 11°.0.34 - 20156{,}658.9.81\sin 11°$$
$$= 28265{,}340\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 11° dapat dilihat dalam Tabel 4.14.

Tabel 4. 14 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 11°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14463.422	8268.837	6194.585
2	ATR 72	5415	17729.356	10135.993	7593.363
3	DC-9-15	9565,2825	31317.876	17904.642	13413.234
4	DC-10-40	29894,6	97878.487	55957.796	41920.691
5	MD-11	32453,6625	106257.163	60747.942	45509.221
6	B739ER	20156,658	65995.304	37729.963	28265.340
7	B748	26498,01	86757.636	49599.930	37157.706
8	B753	14191.211	46463.719	26563.624	19900.095
9	B773ER	27068,195	88624.500	50667.228	37957.271
10	A339	28404,75	93000.540	53169.041	39831.500
11	A359	32585	106687.178	60993.784	45693.394
12	A388	22592,71	73971.223	42289.850	31681.372

m. Kemiringan 12° (g = 21,2 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 12°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$

$$R = 20156{,}658.9.81\cos 12°.0.34 - 20156{,}658.9.81\sin 12°$$
$$= 24649.574\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 12° dapat dilihat dalam Tabel 4.15.

Tabel 4. 15 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 12°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14412.153	9009.993	5402.160
2	ATR 72	5415	17666.511	11044.508	6622.003
3	DC-9-15	9565,2825	31206.863	19509.481	11697.382
4	DC-10-40	29894,6	97531.536	60973.435	36558.101
5	MD-11	32453,6625	105880.512	66192.934	39687.578
6	B739ER	20156,658	65761.370	41111.796	24649.574
7	B748	26498,01	86450.106	54045.698	32404.408
8	B753	14191.211	46299.018	28944.589	17354.430
9	B773ER	27068,195	88310.352	55208.661	33101.691
10	A339	28404,75	92670.881	57934.717	34736.164
11	A359	32585	106309.003	66460.812	39848.191
12	A388	22592,71	73709.016	46080.397	27628.619

n. Kemiringan 13° (g = 23 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 13°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$

$$R = 20156{,}658.9.81\cos 13°.0.34 - 20156{,}658.9.81\sin 13°$$
$$= 21026{,}299\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 13° dapat dilihat dalam Tabel 4.16.

Tabel 4. 16 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 13°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14356.495	9748.406	4608.089
2	ATR 72	5415	17598.284	11949.659	5648.625
3	DC-9-15	9565,2825	31086.345	21108.377	9977.968
4	DC-10-40	29894,6	97154.876	65970.502	31184.375
5	MD-11	32453,6625	105471.609	71617.764	33853.846
6	B739ER	20156,658	65507.404	44481.106	21026.299
7	B748	26498,01	86116.242	58475.003	27641.239
8	B753	14191.211	46120.215	31316.737	14803.478
9	B773ER	27068,195	87969.304	59733.276	28236.027
10	A339	28404,75	92312.992	62682.746	29630.247
11	A359	32585	105898.445	71907.595	33990.850
12	A388	22592,71	73424.357	49856.907	23567.450

o. Kemiringan 14° (g = 25 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 14°

$R = mg.cos\,\theta.\mu - mg.\sin\theta$

$R = 20156{,}658.9.81\cos 14°.0.34 - 20156{,}658.9.81\sin 14°$
$= 17396.619\ N$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 14° dapat dilihat dalam Tabel 4.17.

Tabel 4. 17 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 14°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14296.463	10483.849	3812.614
2	ATR 72	5415	17524.696	12851.169	4673.527
3	DC-9-15	9565,2825	30956.357	22700.843	8255.514
4	DC-10-40	29894,6	96748.622	70947.473	25801.149
5	MD-11	32453,6625	105030.579	77020.778	28009.801
6	B739ER	20156,658	65233.484	47836.866	17396.619
7	B748	26498,01	85756.146	62886.496	22869.650
8	B753	14191.211	45927.363	33679.346	12248.017
9	B773ER	27068,195	87601.459	64239.697	23361.762
10	A339	28404,75	91926.985	67411.681	24515.304
11	A359	32585	105455.629	77332.475	28123.155
12	A388	22592,71	73117.332	53618.231	19499.102

p. Kemiringan 15° (g = 26,8 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 15°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$

$$R = 20156{,}658.9.81\cos 15°.0.34 - 20156{,}658.9.81\sin 15°$$
$$= 13761.639\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 15° dapat dilihat dalam Tabel 4.18.

Tabel 4. 18 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 15°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14232.076	11216.098	3015.978
2	ATR 72	5415	17445.771	13748.765	3697.006
3	DC-9-15	9565,2825	30816.939	24286.394	6530.545
4	DC-10-40	29894,6	96312.898	75902.833	20410.065
5	MD-11	32453,6625	104557.555	82400.330	22157.224
6	B739ER	20156,658	64939.694	51178.054	13761.639
7	B748	26498,01	85369.928	67278.833	18091.095
8	B753	14191.211	45720.521	36031.696	9688.825
9	B773ER	27068,195	87206.930	68726.549	18480.382
10	A339	28404,75	91512.975	72120.082	19392.893
11	A359	32585	104980.691	82733.798	22246.893
12	A388	22592,71	72788.036	57363.222	15424.814

q. Kemiringan 16° (g = 28,7 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 16°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$

$$R = 20156{,}658.9.81\cos 16°.0.34 - 20156{,}658.9.81\sin 16°$$
$$= 9285.361\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 16° dapat dilihat dalam Tabel 4.19.

Tabel 4. 19 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 16°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14163.354	11944.931	2218.423
2	ATR 72	5415	17361.531	14642.173	2719.358
3	DC-9-15	9565,2825	30668.135	25864.547	4803.587
4	DC-10-40	29894,6	95847.835	80835.072	15012.763
5	MD-11	32453,6625	104052.682	87754.783	16297.898
6	B739ER	20156,658	59281.674	49996.313	9285.361
7	B748	26498,01	84957.705	71650.676	13307.029
8	B753	14191.211	45499.752	38373.070	7126.682
9	B773ER	27068,195	86785.837	73192.466	13593.371
10	A339	28404,75	91071.090	76806.514	14264.576
11	A359	32585	104473.775	88109.920	16363.855
12	A388	22592,71	72436.567	61090.739	11345.828

r. Kemiringan 17° (g = 30,6 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 17°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$

$$R = 20156{,}658.9.81\cos 17°.0.34 - 20156{,}658.9.81\sin 17°$$
$$= 6480{,}214\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 17° dapat dilihat dalam Tabel 4.20.

Tabel 4. 20 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 17°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14090.318	12670.125	1420.193
2	ATR 72	5415	17272.003	15531.121	1740.882
3	DC-9-15	9565,2825	30509.988	27434.822	3075.166
4	DC-10-40	29894,6	95353.576	85742.688	9610.888
5	MD-11	32453,6625	103516.113	93082.505	10433.608
6	B739ER	20156,658	64292.864	57812.650	6480.214
7	B748	26498,01	84519.603	76000.694	8518.909
8	B753	14191.211	45265.123	40702.756	4562.367
9	B773ER	27068,195	86338.309	77636.088	8702.221
10	A339	28404,75	90601.463	81469.550	9131.913
11	A359	32585	103935.035	93459.203	10475.832
12	A388	22592,71	72063.033	64799.647	7263.385

s. Kemiringan 18° (g = 32,5 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 18°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$

$$R = 20156{,}658.9.81\cos 18°.0.34 - 20156{,}658.9.81\sin 18°$$
$$= 2835.985\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 18° dapat dilihat dalam Tabel 4.21.

Tabel 4. 21 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 18°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	14012.990	13391.460	621.530
2	ATR 72	5415	17177.213	16415.338	761.875
3	DC-9-15	9565,2825	30342.548	28996.740	1345.808
4	DC-10-40	29894,6	94830.272	90624.186	4206.086
5	MD-11	32453,6625	102948.012	98381.873	4566.139
6	B739ER	20156,658	63940.022	61104.037	2835.985
7	B748	26498,01	84055.756	80327.561	3728.195
8	B753	14191.211	45016.706	43020.043	1996.664
9	B773ER	27068,195	85864.480	82056.061	3808.419
10	A339	28404,75	90104.239	86107.770	3996.468
11	A359	32585	103364.635	98780.017	4584.618
12	A388	22592,71	71667.548	68488.817	3178.731

t. Kemiringan 19° (g = 34,4 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 19°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$

$$R = 20156{,}658.9.81\cos 19°.0.34 - 20156{,}658.9.81\sin 19°$$
$$= -809.107\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 19° dapat dilihat dalam Tabel 4.22.

Tabel 4. 22 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 19°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	13931.393	14108.716	-177.323
2	ATR 72	5415	17077.192	17294.555	-217.363
3	DC-9-15	9565,2825	30165.866	30549.825	-383.959
4	DC-10-40	29894,6	94278.082	95478.079	-1199.997
5	MD-11	32453,6625	102348.553	103651.273	-1302.720
6	B739ER	20156,658	63567.704	64376.811	-809.107
7	B748	26498,01	83566.305	84629.960	-1063.655
8	B753	14191.211	44754.577	45324.225	-569.649
9	B773ER	27068,195	85364.497	86451.040	-1086.543
10	A339	28404,75	89579.567	90719.761	-1140.193
11	A359	32585	102762.749	104070.742	-1307.992
12	A388	22592,71	71250.232	72157.125	-906.893

u. Kemiringan 20° (g = 36,4 %)

Data diketahui:

m_{tire} = 20156,658 kg
μ = 0.34
g = 9.81 m/s^2
θ = 20°

$$R = mg.cos\,\theta.\mu - mg.\sin\theta$$

$$R = 20156{,}658.9.81\cos 20°.0.34 - 20156{,}658.9.81\sin 20°$$
$$= -4453{,}953\ N$$

Dengan menggunakan metode perhitungan yang sama dengan contoh perhitungan diatas maka diperoleh hasil yang berbeda-beda tergantung dari tipe pesawat yang ditinjau, rekapitulasi hasil perhitungan gaya resultan yang terjadi akibat kemiringan gradien 20° dapat dilihat dalam Tabel 4.23.

Tabel 4. 23 Rekapitulasi Perhitungan Gaya Resultan akibat Gradien 20°

No	Jenis Pesawat	Gaya Berat pada tiap Roda (kg)	Gaya Tahanan - Friksi (N)	Gaya Berat Pesawat (N)	Resultan Gaya (N)
1	ATR 42	4417,5	13845.553	14821.674	-976.121
2	ATR 72	5415	16971.968	18168.503	-1196.535
3	DC-9-15	9565,2825	29979.994	32093.604	-2113.610
4	DC-10-40	29894,6	93697.173	100302.888	-6605.715
5	MD-11	32453,6625	101717.917	108889.100	-7171.183
6	B739ER	20156,658	63176.022	67629.975	-4453.953
7	B748	26498,01	83051.399	88906.580	-5855.181
8	B753	14191.211	44478.815	47614.602	-3135.787
9	B773ER	27068,195	84838.511	90819.684	-5981.173
10	A339	28404,75	89027.609	95304.117	-6276.508
11	A359	32585	102129.561	109329.766	-7200.204
12	A388	22592,71	70811.213	75803.453	-4992.239

Dari hasil perhitungan dengan metode *trial and error* dengan meninjau beberapa nilai kemiringan gradien diperoleh rekapitulasi hasil resultan gaya yang terjadi yang disajikan dalam Tabel 4.24. Hasil tesebut kemudian diplotting ke dalam grafik hubungan antara gaya berat tiap roda dengan resultan gaya yang bekerja. Grafik hubungan antara gaya berat pesawat pada tiap roda dengan resultan gaya ditunjukkan pada Gambar 4.3.

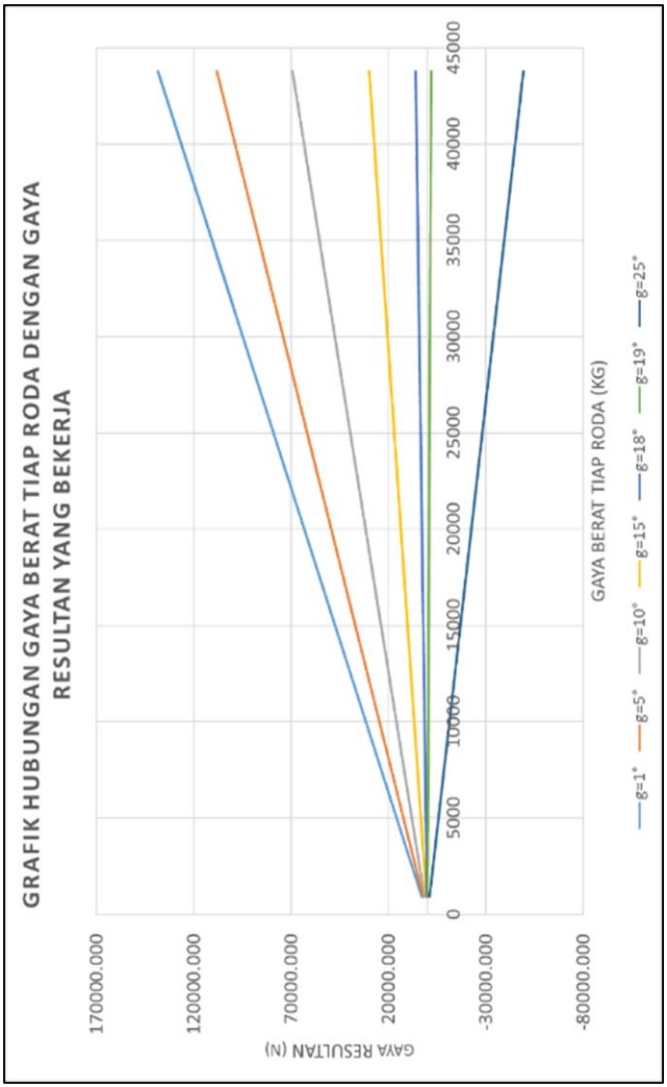
Tabel 4. 24 Rekapitulasi Perhitungan Gaya Resultan akibat Beberapa Gradien Kemiringan

Tipe Pesawat	Resultan Gaya (N)						
	G = 1°	G = 5°	G = 10°	G = 15°	G = 18°	G = 19°	G = 25°
ATR 42	13975.57	10901.11	6985.124	3015.978	621.5298	-177.323	-4960.79
ATR 72	17131.35	13362.65	8562.41	3697.006	761.8753	-217.363	-6080.97
DC-9-15	30261.53	23604.34	15125	6530.545	1345.808	-383.959	-10741.7
DC-10-40	94577.06	73771.2	47270.51	20410.06	4206.086	-1200	-33571.2
MD-11	102673.1	80086.23	51317	22157.22	4566.139	-1302.72	-36445
B739ER	63769.3	49740.79	31872.5	13761.64	2835.985	-809.107	-22635.6
B748	83831.32	65389.4	41899.69	18091.09	3728.195	-1063.65	-29756.9
B753	85635.21	66796.45	42801.29	18480.38	3808.419	-1086.54	-30397.2
B773ER	103088.6	80410.33	51524.68	22246.89	4584.618	-1307.99	-36592.5
A339	71476.19	55752.25	35724.48	15424.81	3178.731	-906.893	-25371.3

Dari hasil perhitungan dan plotting pada grafik pada Gambar 4.3 menunjukkan variasi sudut yang menghasilkan gaya resultan yang dipengaruhi gaya berat. Diperoleh hasil bahwa kemiringan kritis dari holding position agar pesawat tidak tergelincir memasuki runway adalah 18°. Hal ini dibuktikan dengan nilai resultan antara gaya gelincir (akibat gaya berat pesawat) dengan gaya tahanan (akibat dari skid resistance perkerasan dengan roda pesawat) bernilai diatas nilai nol ($R \geq 0$).

Pada Gambar 4.3 dapat dilihat untuk sudut 1°, 5°, 10°, dan 18° yang sudah memiliki nilai resultan diatas nol ($R \geq 0$). Sedangkan ketika nilai gradien diperhitungkan dengan menggunakan nilai kemiringan 19°, nilai resultan gaya yang bekerja sudah berada dibawah nilai nol ($R < 0$). Hal ini membuktikan bahwa batas gradien kemiringan dari holding position yang paling kritis adalah 18° untuk setiap tipe pesawat.

Oleh karena itu, untuk perancangan kemiringan holding position dapat digunakan kemiringan 0 hingga 18°, yang merupakan nilai batas keamanan untuk mencegah pesawat tergelincir memasuki runway ketika dalam keadaan holding. Akan tetapi dalam penerapan di lapangan kemiringan mencapai 18° tidak mungkin terjadi oleh karena itu kemiringan taxiway untuk holding position dapat menggunakan kemiringan maksimum untuk taxiway yaitu sebesar 3 % yang mengacu pada peraturan perencanaan kemiringan memanjang taxiway menurut Direktorat Jendral Perhubungan Udara dalam SKEP 77-VI-2005.



Gambar 4. 3 Grafik Hubungan Gaya Berat tiap Roda dengan Gaya Resultan

4.3 Analisis Kemampuan Kecepatan Pesawat untuk Keluar dari Runway terhadap Kemiringan Exit Taxiway Akibat Adanya Perbedaan Tinggi Runway dan Ujung Exit Taxiway

4.3.1 Analisis Kemampuan Kecepatan Pesawat

Ketika pesawat telah mendarat secara sempurna, tahapan selanjutnya yang harus dilalui pesawat adalah masuk ke *exit taxiway* dan kemudian melakukan parkir di bagian apron. Ada kalanya kondisi dari *exit taxiway* memiliki kemiringan tertentu akibat adanya perbedaan tinggi antara *runway* dan ujung *exit taxiway*. Oleh karena itu diperlukan analisa terhadap kemampuan dari suatu pesawat untuk berjalan dari *runway* hingga ke ujung *taxiway*. Kemampuan dari pesawat tersebut akan bergantung dari beberapa hal yaitu:

1. Maximum Landing Weight

   Maximum landing weight merupakan berat yang digunakan dalam analisa kemampuan pesawat berjalan di *exit taxiway*. Hal ini dikarenakan *maximum landing weight* merupakan berat representasi dari pesawat yang baru saja mendarat yang akan memasuki *exit taxiway*. Maka dari itu dalam analisa ini diperlukan data *maximum landing weight* yang diperoleh dari *manual airport planning*. Berikut merupakan contoh tabel nilai maximum landing weight untuk pesawat Boeing 737-900ER yang didapatkan dari *airport manual* untuk pesawat Boeing 737 Series yang ditampilkan dalam Tabel 4.25.

Tabel 4. 25 Maximum Landing Weight B737-900ER

CHARACTERISTICS	UNITS	MODEL 737-900ER, -900ER WITH WINGLETS		
MAX DESIGN TAXI WEIGHT	POUNDS	164,500		188,200
	KILOGRAMS	74,616		85,366
MAX DESIGN TAKEOFF WEIGHT	POUNDS	164,000		187,700
	KILOGRAMS	74,389		85,139
MAX DESIGN LANDING WEIGHT	POUNDS	146,300		157,300
	KILOGRAMS	66,361		71,350
MAX DESIGN ZERO FUEL WEIGHT	POUNDS	138,300		149,300
	KILOGRAMS	62,732		67,721
OPERATING EMPTY WEIGHT (1)	POUNDS	98,495		98,495
	KILOGRAMS	44,677		44,677
MAX STRUCTURAL PAYLOAD	POUNDS	39,308		50,805
	KILOGRAMS	17,830		23,045
SEATING CAPACITY (1)	TWO-CLASS	177		177
	ALL-ECONOMY	186 WITH MID EXIT DOOR, 215: FAA EXIT LIMIT		
AUXILIARY FUEL OPTIONS	SEE NOTES	(2)	(3)	(4)
MAX CARGO - LOWER DECK	CUBIC FEET	1,826	1,676	1,587
	CUBIC METERS	51.7	47.5	44.9
USABLE FUEL	US GALLONS	6,875	7,390	7,837
	LITERS	26,025	27,974	29,666
	POUNDS	46,063	49,513	52,508
	KILOGRAMS	20,894	22,459	23,817

(Sumber: Airport Planning Manual Boeing 737, 2018)

2. Jenis Engine dari Pesawat

Dalam menganalisa kemampuan dari suatu pesawat dibutuhkan pula data dari mesin propulsi yang digunakan oleh pesawat tersebut. Mesin propulsi ini dikategorikan berdasarkan tipe penghasil *thrust* yang digunakan yaitu *turbofan engine*, *turboprop engine*, dan *turbojet engine*. Setiap mesin propulsi memiliki gaya besar dorong (*thrust*) yang berbeda-beda tipe satu dengan yang lain, maka dari itu dibutuhkan data tipe *engine* yang digunakan dan berapa besar gaya *thrust* yang mampu dikeluarkan oleh pesawat tersebut. Data ini diperoleh dari airport manual untuk setiap tipe pesawat yang kemudian dicocokkan dengan brosur atau *database engine propulsion* dari perusahaan pengembang mesin propulsi seperti Pratt & Whitney, Rolls Royce, General Electric, dan Honeywell. Rincian dan daftar lengkap mengenai *engine propulsion* dan nilai gaya dorong (*thrust*) yang dihasilkan juga dapat diperoleh berdasarkan *database* yang diperoleh dari website www.jet-engine.net.

3. Jumlah Engine

Selain tipe engine yang digunakan perlu juga diketahui data berapa jumlah engine yang digunakan oleh pesawat tersebut. Dengan mengetahui jumlah engine yang digunakan maka besar gaya dorong (thrust) yang dihasilkan akan berlaku kelipatannya tergantung dari jumlah engine yang di aplikasikan pada pesawat. Umumnya jumlah engine pada pesawat berjumlah genap akan tetapi ada beberapa pesawat yang menggunakan engine dengan jumlah ganjil seperti pada pesawat DC-10 dan MD-11.

4. Syarat Kecepatan ketika *Taxiing*

Berdasarkan literatur yang terdapat pada bab sebelumnya mengenai kecepatan pesawat di *taxiway* telah ditetapkan kecepatan pesawat dalam keadaan *taxiing*. Kecepatan pesawat ketika *taxiing* berkisar antara 5 hingga 20 knots (9 hingga 37 km/jam, 6 hingga 23 mil/jam atau setara dengan 2,6 hingga 10,3 m/s). Namun pada kenyataan dilapangan pada posisi keluar dari *runway* sebelum memasuki *exit taxiway* kecepatan pesawat digunakan kecepatan yang lebih tinggi. Pada analisa ini digunakan kecepatan 10 knot yaitu kecepatan maksimum pesawat ketika melakukan belokan atau memasuki *ramp area* (Boeing 737-NG Flight Manual for Ground Operations, 2018).

4.3.2 Analisis Kecepatan Maksimum Taxiing Pesawat Berjalan di Exit Taxiway Yang Memiliki Kemiringan Terhadap Kemampuan Gaya Dorong Pesawat

Seperti yang disebutkan pada poin sebelumnya, bahwasanya pesawat yang telah mendarat harus memasuki *exit taxiway* sebelumnya akhirnya parkir di area apron. Pada area *exit taxiway* dengan kemiringan tertentu diperlukan analisa dan perhitungan terhadap kemampuan pesawat untuk memenuhi persyaratan yang diisyaratkan untuk melakukan *exit taxiing*. Pada praktik dilapangan digunakan kecepatan digunakan ketika pesawat dalam keadaan *taxiing* berkisar antara 10 hingga 20 knot (5.2 m/s hingga 10.3 m/s). Kecepatan ini juga yang akan digunakan sebagai kecepatan batas kemampuan suatu pesawat untuk berjalan melewati *exit taxiway* dengan kemiringan tertentu.

Dengan kata lain, jika kecepatan hasil perhitungan lebih kecil dari kecepatan batas minimum maka dapat dikatakan kemampuan gaya dorong mesin pesawat tersebut tidak mampu melewati *exit taxiway* (Vperhitungan < Vbatas). Sedangkan jika kecepatan hasil perhitungan pesawat dapat melebihi batas maksimum kecepatan maka dapat dikatakan pesawat tersebut mampu *exit taxiway* yang memiliki kemiringan tertentu. Dalam perhitungan ini akan dianalisa kemiringan kritis terhadap semua jenis pesawat sehingga diperoleh kemiringan maksimal dalam perancangan. Adapun rumusan yang digunakan sebagai acuan dasar perhitungan kecepatan akibat gaya thrust dan kemiringan digunakan rumusan berikut.

$$e.n_{engine}.F_{engine} = V.W_{MLW}.sin\theta \quad (4.5)$$

$$V = \frac{e.n_{engine}.F_{engine}}{W_{MLW}.sin\theta} \quad (4.6)$$

dimana:

V = Kecepatan pesawat berjalan di *taxiway* (m/s)
e = Efisiensi mesin (digunakan e = 0.75)
F = gaya thrust yang dihasilkan mesin (lbf)
n_{engine} = jumlah mesin jet yang digunakan
W_{MLW} = berat maksimum pendaratan (kg)
θ = kemiringan (°)

Berikut contoh perhitungan untuk kecepatan pesawat melakukan *exit taxiing* dengan meninjau pesawat Boeing 737-900ER dengan berbagai gradien.

a. Gradien 0.5° (g = 0,87 %)

Data diketahui:

Jenis = Boeing 737-900ER
Tipe Mesin = CFM56-7B27
E = 0.75
n = 2
F = 27300 lbf
W_{mlw} = 71350 kg
θ = 0,5°

$$V = \frac{e.n_{engine}.F_{engine.}}{W_{MLW}.sin\theta}$$

$$V = \frac{0.75.2.27300}{71350\ .\ sin\ 0.5^{\circ}} = 14{,}9115 \text{ m/s}$$

V = 28,822 m/s > 5.2 m/s (OK)

Dari hasil perhitungan dengan meninjau jenis pesawat Boeing 737-900ER diperoleh hasil kecepatan pesawat melakukan *exit taxiing* adalah 28,822 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 0,5°, pesawat Boeing 737-900ER masih mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

Dengan metode perhitungan yang sama dapat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* untuk tipe pesawat yang berbeda. Rekapitulasi perhitungan untuk kecepatan pesawat *exit taxiing* dan analisa kemampuan pesawat melakukan *exit taxiing* dengan gradien 0,5° ditampilkan dalam Tabel 4.26.

Tabel 4. 26 Rekapitulasi Perhitungan Kecepatan dengan Gradien 0,5°

No	Jenis Pesawat	MLW (kg)	Jenis Mesin	N engine	Power engine (lbf)	V (m/s)	Ket.
1	DC-9-15	37059	P&W JT8D-7	2	14000	29,444	OK
2	DC-10-40	182798	P&W JT9D-20	3	49400	31,594	OK
3	MD-11 Freighter	213872	CF6-80C2D1F	3	60690	33,176	OK
4	B739ER	66814	CFM56-7B27	2	27300	29,822	OK
5	B748	312072	GEnx-2B67B	4	66498	33,216	OK
6	B753	101610	P&W PW2043	2	42600	32,677	OK
7	B773ER	251290	GE90-110B1	2	110760	34,354	OK
8	A339	191000	P&W PW4168A	2	70000	27,993	OK
9	A359	205000	Trent XWB-84	2	84000	31,937	OK
10	A388	390000	Engine Alliance GP7270	2	74700	27,625	OK

Dari hasil perhitungan dengan meninjau semua jenis pesawat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* berada diatas nilai kecepatan minimum yang diisyaratkan yaitu 5,2 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 0,5°, semua tipe pesawat masih mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

b. Gradien 1° (g = 1,75 %)

Data diketahui:

Jenis = Boeing 737-900ER
Tipe Mesin = CFM56-7B27
e = 0.75
n = 2
F = 27300 lbf
W_{mlw} = 71350 kg
θ = 1°

$$V = \frac{e.n_{engine}.F_{engine.}}{W_{MLW}.sin\theta}$$

$$V = \frac{0.75.2.27300}{71350\ .\ sin1°} = 14{,}9115 \text{ m/s}$$

V = 14,9115 m/s > 5.2 m/s (OK)

Dari hasil perhitungan dengan meninjau jenis pesawat Boeing 737-900ER diperoleh hasil kecepatan pesawat melakukan *exit taxiing* adalah 14,9115 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 1°, pesawat Boeing 737-900ER masih mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

Dengan metode perhitungan yang sama dapat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* untuk tipe pesawat yang berbeda. Rekapitulasi perhitungan untuk kecepatan pesawat *exit taxiing* dan analisa kemampuan pesawat melakukan *exit taxiing* dengan gradien 1° ditampilkan dalam Tabel 4.27.

Tabel 4. 27 Rekapitulasi Perhitungan Kecepatan dengan Gradien 1°

No	Jenis Pesawat	MLW (kg)	Jenis Mesin	N engine	Power engine (lbf)	V (m/s)	Ket.
1	DC-9-15	37059	P&W JT8D-7	2	14000	14,723	OK
2	DC-10-40	182798	P&W JT9D-20	3	49400	15,798	OK
3	MD-11 Freighter	213872	CF6-80C2D1F	3	60690	16,588	OK
4	B739ER	66814	CFM56-7B27	2	27300	14,911	OK
5	B748	312072	GEnx-2B67B	4	66498	16,609	OK
6	B753	101610	P&W PW2043	2	42600	16,339	OK
7	B773ER	251290	GE90-110B1	2	110760	17,173	OK
8	A339	191000	P&W PW4168A	2	70000	13,997	OK
9	A359	205000	Trent XWB-84	2	84000	15,969	OK
10	A388	390000	Engine Alliance GP7270	2	74700	13.8128	OK

Dari hasil perhitungan dengan meninjau semua jenis pesawat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* berada diatas nilai kecepatan minimum yang diisyaratkan yaitu 5,2 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 1°, semua tipe pesawat masih mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

c. Gradien 1,5° (g = 2,6 %)

Data diketahui:

Jenis = Boeing 737-900ER
Tipe Mesin = CFM56-7B27
e = 0.75
n = 2
F = 27300 lbf
W_{mlw} = 71350 kg
θ = 1,5°

$$V = \frac{e.n_{engine}.F_{engine.}}{W_{MLW}.sin\theta}$$

$$V = \frac{0.75.2.27300}{71350\ .\ sin1.5^{\circ}} = 14{,}9115 \text{ m/s}$$

V = 9,942 m/s > 5.2 m/s (OK)

Dari hasil perhitungan dengan meninjau jenis pesawat Boeing 737-900ER diperoleh hasil kecepatan pesawat melakukan *exit taxiing* adalah 9,942 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 1,5°, pesawat Boeing 737-900ER masih mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

Dengan metode perhitungan yang sama dapat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* untuk tipe pesawat yang berbeda. Rekapitulasi perhitungan untuk kecepatan pesawat *exit taxiing* dan analisa kemampuan pesawat melakukan *exit taxiing* dengan gradien 1,5° ditampilkan dalam Tabel 4.28.

Tabel 4. 28 Rekapitulasi Perhitungan Kecepatan dengan Gradien 1,5°

No	Jenis Pesawat	MLW (kg)	Jenis Mesin	N engine	Power engine (lbf)	V (m/s)	Ket.
1	DC-9-15	37059	P&W JT8D-7	2	14000	9,816	OK
2	DC-10-40	182798	P&W JT9D-20	3	49400	10,533	OK
3	MD-11 Freighter	213872	CF6-80C2D1F	3	60690	11,059	OK
4	B739ER	66814	CFM56-7B27	2	27300	9,942	OK
5	B748	312072	GEnx-2B67B	4	66498	11,073	OK
6	B753	101610	P&W PW2043	2	42600	10,893	OK
7	B773ER	251290	GE90-110B1	2	110760	11,452	OK
8	A339	191000	P&W PW4168A	2	70000	9,332	OK
9	A359	205000	Trent XWB-84	2	84000	10,647	OK
10	A388	390000	Engine Alliance GP7270	2	74700	9,209	OK

Dari hasil perhitungan dengan meninjau semua jenis pesawat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* berada diatas nilai kecepatan minimum yang diisyaratkan yaitu 5,2 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 1,5°, semua tipe pesawat masih mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

d. Gradien 2° (g = 3,5 %)

Data diketahui:

Jenis = Boeing 737-900ER
Tipe Mesin = CFM56-7B27
e = 0.75
n = 2
F = 27300 lbf
W_{mlw} = 71350 kg
θ = 2°

$$V = \frac{e.n_{engine}.F_{engine}}{W_{MLW}.sin\theta}$$

$$V = \frac{0.75.2.27300}{157300.sin2°} = 7{,}965 \text{ m/s}$$

V = 7,965 m/s > 5.2 m/s (OK)

Dari hasil perhitungan dengan meninjau jenis pesawat Boeing 737-900ER diperoleh hasil kecepatan pesawat melakukan *exit taxiing* adalah 7,965 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 2°, pesawat Boeing 737-900ER masih mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

Dengan metode perhitungan yang sama dapat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* untuk tipe pesawat yang berbeda. Rekapitulasi perhitungan untuk kecepatan pesawat *exit taxiing* dan analisa kemampuan pesawat melakukan *exit taxiing* dengan gradien 2° ditampilkan dalam Tabel 4.29.

Tabel 4. 29 Rekapitulasi Perhitungan Kecepatan dengan Gradien 2°

No	Jenis Pesawat	MLW (lb)	Jenis Mesin	N engine	Power engine (lbf)	V (m/s)	Ket.
1	DC-9-15	37059	P&W JT8D-7	2	14000	7,365	OK
2	DC-10-40	182798	P&W JT9D-20	3	49400	7,900	OK
3	MD-11 Freighter	213872	CF6-80C2D1F	3	60690	8,295	OK
4	B739ER	66814	CFM56-7B27	2	27300	7,457	OK
5	B748	312072	GEnx-2B67B	4	66498	8,305	OK
6	B753	101610	P&W PW2043	2	42600	8,171	OK
7	B773ER	251290	GE90-110B1	2	110760	8,590	OK
8	A339	191000	P&W PW4168A	2	70000	6,999	OK
9	A359	205000	Trent XWB-84	2	84000	7,986	OK
10	A388	390000	Engine Alliance GP7270	2	74700	6,907	OK

Sumber: Hasil Perhitungan, 2018

Dari hasil perhitungan dengan meninjau semua jenis pesawat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* berada diatas nilai kecepatan minimum yang diisyaratkan yaitu 5,2 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 2°, semua tipe pesawat masih mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

e. Gradien 2,5° (g = 4,4 %)

Data diketahui:

Jenis = Boeing 737-900ER
Tipe Mesin = CFM56-7B27
e = 0.75
n = 2
F = 27300 lbf
W_{mlw} = 71350 kg
θ = 2,5°

$$V = \frac{e.n_{engine}.F_{engine}}{W_{MLW}.sin\theta}$$

$$V = \frac{0.75.2.27300}{71350.sin2{,}5^{\circ}} = 7{,}965 \text{ m/s}$$

V = 5,966 m/s > 5.2 m/s (OK)

Dari hasil perhitungan dengan meninjau jenis pesawat Boeing 737-900ER diperoleh hasil kecepatan pesawat melakukan *exit taxiing* adalah 5,966 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 2°, pesawat Boeing 737-900ER masih mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

Dengan metode perhitungan yang sama dapat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* untuk tipe pesawat yang berbeda. Rekapitulasi perhitungan untuk kecepatan pesawat *exit taxiing* dan analisa kemampuan pesawat melakukan *exit taxiing* dengan gradien 2,5° ditampilkan dalam Tabel 4.30.

Tabel 4. 30 Rekapitulasi Perhitungan Kecepatan dengan Gradien 2,5°

No	Jenis Pesawat	MLW (lb)	Jenis Mesin	N engine	Power engine (lbf)	V (m/s)	Ket.
1	DC-9-15	37059	P&W JT8D-7	2	14000	5,891	OK
2	DC-10-40	182798	P&W JT9D-20	3	49400	6,321	OK
3	MD-11 Freighter	213872	CF6-80C2D1F	3	60690	6,637	OK
4	B739ER	66814	CFM56-7B27	2	27300	5,966	OK
5	B748	312072	GEnx-2B67B	4	66498	6,645	OK
6	B753	101610	P&W PW2043	2	42600	6,537	OK
7	B773ER	251290	GE90-110B1	2	110760	6,873	OK
8	B777-9	266258	RR Trent 1000-J2	2	78129	4,575	Not OK
9	A339	191000	P&W PW4168A	2	70000	5,600	OK
10	A359	205000	Trent XWB-84	2	84000	6,389	OK
11	A388	390000	Engine Alliance GP7270	2	74700	5,527	OK

Dari hasil perhitungan dengan meninjau semua jenis pesawat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* terdapat pesawat yang memiliki nilai kecepatan dibawah nilai kecepatan minimum yang diisyaratkan yaitu 5,2 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 2,5°, terdapat tipe pesawat tidak mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

f. Gradien 3° (g = 5,2 %)

Data diketahui:

Jenis = Boeing 737-900ER
Tipe Mesin = CFM56-7B27
e = 0.75
n = 2
F = 27300 lbf
W_{mlw} = 71350 kg
θ = 3°

$$V = \frac{e.n_{engine}.F_{engine}}{W_{MLW}.sin\theta}$$

$$V = \frac{0.75.2.27300}{71350\ .sin\ 3^{\circ}} = 4{,}974 \text{ m/s}$$

V = 4,974 m/s < 5.2 m/s (Not OK)

Dari hasil perhitungan dengan meninjau jenis pesawat Boeing 737-900ER diperoleh hasil kecepatan pesawat melakukan *exit taxiing* adalah 4,974 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 3°, pesawat Boeing 737-900ER tidak mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

Dengan metode perhitungan yang sama dapat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* untuk tipe pesawat yang berbeda. Rekapitulasi perhitungan untuk kecepatan pesawat *exit taxiing* dan analisa kemampuan pesawat melakukan *exit taxiing* dengan gradien 3° ditampilkan dalam Tabel 4.31.

Tabel 4. 31 Rekapitulasi Perhitungan Kecepatan dengan Gradien 3°

No	Jenis Pesawat	MLW (kg)	Jenis Mesin	N engine	Power engine (lbf)	V (m/s)	Ket.
1	DC-9-15	37059	P&W JT8D-7	2	14000	4,909	Not OK
2	DC-10-40	182798	P&W JT9D-20	3	49400	5,268	OK
3	MD-11 Freighter	213872	CF6-80C2D1F	3	60690	5,531	OK
4	B739ER	66814	CFM56-7B27	2	27300	4,972	Not OK
5	B748	312072	GEnx-2B67B	4	66498	5,538	OK
6	B753	101610	P&W PW2043	2	42600	5,448	OK
7	B773ER	251290	GE90-110B1	2	110760	5,728	OK
8	A339	191000	P&W PW4168A	2	70000	4,667	Not OK
9	A359	205000	Trent XWB-84	2	84000	5,325	OK
10	A388	390000	Engine Alliance GP7270	2	74700	4,606	Not OK

Dari hasil perhitungan dengan meninjau semua jenis pesawat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* terdapat pesawat yang memiliki nilai kecepatan dibawah nilai kecepatan minimum yang diisyaratkan yaitu 5,2 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 3°, terdapat tipe pesawat tidak mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

g. Gradien 4° (g = 7 %)

Data diketahui:

Jenis = Boeing 737-900ER
Tipe Mesin = CFM56-7B27
e = 0.75
n = 2
F = 27300 lbf
W_{mlw} = 71350 kg
θ = 4°

$$V = \frac{e.n_{engine}.F_{engine}}{W_{MLW}.sin\theta}$$

$$V = \frac{0.75.2.27300}{71350.sin4^{\circ}} = 3{,}732 \text{ m/s}$$

V = 3,732 m/s < 5.2 m/s (Not OK)

Dari hasil perhitungan dengan meninjau jenis pesawat Boeing 737-900ER diperoleh hasil kecepatan pesawat melakukan *exit taxiing* adalah 3,732 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 4°, pesawat Boeing 737-900ER tidak mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

Dengan metode perhitungan yang sama dapat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* untuk tipe pesawat yang berbeda. Rekapitulasi perhitungan untuk kecepatan pesawat *exit taxiing* dan analisa kemampuan pesawat melakukan *exit taxiing* dengan gradien 4° ditampilkan dalam Tabel 4.32.

Tabel 4. 32 Rekapitulasi Perhitungan Kecepatan dengan Gradien 4°

No	Jenis Pesawat	MLW (Kg)	Jenis Mesin	N engine	Power engine (lbf)	V (m/s)	Ket.
1	DC-9-15	37059	P&W JT8D-7	2	14000	3,683	Not OK
2	DC-10-40	182798	P&W JT9D-20	3	49400	3,952	Not OK
3	MD-11 Freighter	213872	CF6-80C2D1F	3	60690	4,150	Not OK
4	B739ER	66814	CFM56-7B27	2	27300	3,731	Not OK
5	B748	312072	GEnx-2B67B	4	66498	4,155	Not OK
6	B753	101610	P&W PW2043	2	42600	4,088	Not OK
7	B773ER	251290	GE90-110B1	2	110760	4,297	Not OK
8	A339	191000	P&W PW4168A	2	70000	3,502	Not OK
9	A359	205000	Trent XWB-84	2	84000	3,995	Not OK
10	A388	390000	Engine Alliance GP7270	2	74700	3,456	Not OK

Dari hasil perhitungan dengan meninjau semua jenis pesawat diperoleh hasil kecepatan pesawat melakukan *exit taxiing* terdapat pesawat yang memiliki nilai kecepatan dibawah nilai kecepatan minimum yang diisyaratkan yaitu 5,2 m/s. Dari nilai tersebut dapat diambil kesimpulan bahwa dengan menggunakan gradien *exit taxiway* sebesar 2,5°, terdapat tipe pesawat tidak mampu melakukan *exit taxiing* menggunakan kecepatan *taxiing* yang diisyaratkan.

Berdasarkan hasil perhitungan yang telah dijabarkan diatas, maka hasil analisis dari kemampuan kecepatan pesawat untuk berjalan melewati *exit taxiway* yang memiliki perbedaan tinggi dengan gradien tertentu diperoleh beberapa simpulan. Dari perhitungan dengan g = 0,5°, g = 1°, g = 1,5 ° dan g = 2° semua tipe pesawat sudah mampu mencapai kecepatan yang diisyaratkan. Akan tetapi ketika gradien sudah mencapai lebih dari 2°, ada beberapa tipe pesawat yang tidak mampu mencapai kecepatan yang diisyaratkan yaitu 10-20 knot atau setara dengan 5,2 m/s hingga 10,3 m/s. Oleh karena itu dapat diambil kesimpulan bahwa batas penggunaan gradien untuk exit taxiway adalah maksimum 2°.

4.4 Analisis Pertambahan Bahan Bakar Akibat Adanya Perbedaan Tinggi Antara Runway dan Ujung Exit Taxiway

4.4.1 Variabel Untuk Analisa Penggunaan Bahan Bakar

Untuk menganalisa tingkat pertambahan konsumsi bahan bakar pesawat akibat dari adanya perbedaan tinggi antara *runway* dan ujung *taxiway*, dibutuhkan beberapa variabel yang berpengaruh. Variabel tersebut akan dijadikan sebagai dasar perhitungan seberapa besar pertambahan bahan bakar yang digunakan oleh sebuah pesawat untuk keluar dari *runway* dan melalui *taxiway* dengan gradien tertentu. Variabel tersebut antara lain sebagai berikut.

a. Maximum Landing Weight

Seperti pada pembahasan sebelumnya, dasar berat pesawat yang digunakan sebagai variabel dalam menganalisa tingkat penggunaan konsumsi bahan bakar dengan kondisi *exit taxiway* yang memiliki gradien adalah berat maximum pendaratan. Maximum landing weight digunakan karena merupakan representasi dari berat pesawat maximum yang digunakan dalam suatu pesawat untuk posisi pendaratan. Maximum landing weight juga merupakan representasi dari berat pesawat yang baru mendarat sebelum keluar dari *runway* dan memasuki *exit taxiway*.

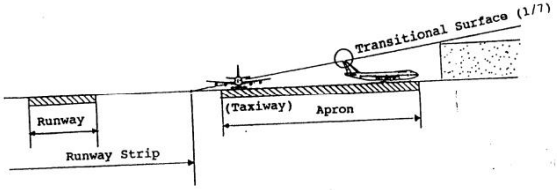
Seperti pada pembahasan sebelumnya, maximum landing weight ini diambil dari Airport Planning Manual dari tiap tipe pesawat. Seperti yang dicontohkan sebelumnya, misalnya untuk pesawat jenis Boeing 737-900ER, maximum landing weight diguakan nilai 71350 kilogram yang diambil dari Airport Planning Manual untuk Boeing 737 Series.

b. Kecepatan Pesawat Taxiing

Seperti pada pembahasan sebelumnya, untuk menganalisa tingkat pertambahan konsumsi bahan bakar digunakan kecepatan pesawat *taxiing* sebesar 10-20 knots atau setara dengan 5,2 m/s hingga 10,3 m/s.

c. Panjang Arah Horizontal Minimum

Dalam peraturan yang berlaku tentang pengoperasian bandar udara yaitu menurut SKEP 77/VI/2005 tentang Persyaratan Teknis Pengoperasian Fasilitas Teknik Bandara, jarak horizontal minimum antara *runway* dengan apron suatu bandara ditentukan dengan suatu persyaratan tertentu. Persarayan teknis tersebut mengisyaratkan jarak minimum antara *runway* dan apron adalah jarak dari garis tengah *runway* hingga ke *runway strip* ditambah dengan jarak horizontal dengan nilai satu per tujuh dari transisional surface yang berpatokan pada tinggi pesawat seperti yang ditunjukkan pada Gambar 4.3. Menurut SKEP/77/VI/2005 juga ditentukan panjang *runway strips* seperti yang terdapat pada Tabel 4.29.



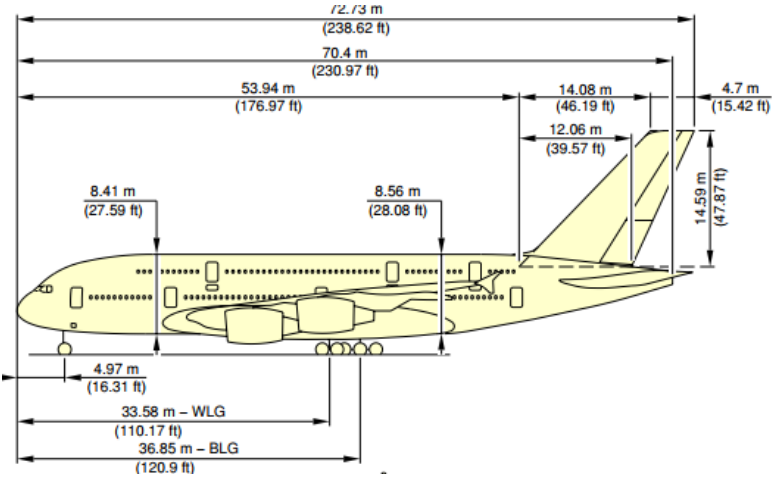
Gambar 4. 4 Persyaratan Teknis Jarak Horizontal Minimum
(Sumber: Dirjen Perhubungan Udara, 2005)

Tabel 4. 33 Lebar *Runway Strips* Minimum

No	Uraian	Code letter / Penggolongan pesawat					
		A / I	B / II	C / III	D / IV	E / V	F / VI
1.	Lebar minimum termasuk landasan(Ws)						
	o Landasan instrument (m)						
	➢ Pendekatan presisi	150	150	300	300	300	300
	➢ Pendekatan non-presisi	150	150	300	300	300	300
	o Landasan non-instrument (m	60	80	150	150	150	150
2.	Permukaan Strip : Tidak boleh ada benda-benda, kecuali alat bantu visual untuk navigasi udara pada strip						
	o Landasan instrument (m)						
	➢ Pendekatan presisi						
	Kategori I	90	90	120	120	120	120
	Kategori II	-	-	120	120	120	120
	Kategori III	-	-	120	120	120	120
3.	Lebar minimum yang diratakan termasuk landasan (m)						
	o Landasan Instrument	80	80	150	150	150	150
	o Landasan non-instrument	60	60	150	150	150	150
4.	Slope kemiringan memanjang (%):						
	o Maksimum yang diratakan	2	2	1,75	1,75	1,75	1,75
	o Perubahan maksimum tiap 30 m pada strip diluar ambang landasan	2	2	2	2	2	2
5.	Slope kemiringan melintang (%) :						
	o Maksimum yang diratakan	< 3	< 3	< 2,5	< 2,5	< 2,5	< 2,5
	o Perubahan maksimum pada 3m pertama dari tepi landasan, bahu landasan, dan stopway	< 5	< 5	< 5	< 5	< 5	< 5
	o Maksimum diluar bagian yang diratakan	< 5	< 5	< 5	< 5	< 5	< 5

(Sumber: Dirjen Perhubungan Udara, 2018)

Dalam perhitungan pertambahan konsumsi bahan bakar, diperlukan perhitungan jarak horizontal minimum sebagai salah satu variabel. Untuk itu perlu ditentukan dahulu tipe pesawat yang akan digunakan sebagai dasar acuan, dalam pembahasan ini akan digunakan tipe pesawat penumpang tipe F yaitu A380 dengan spesifikasi seperti pada Gambar 4.5 dengan *tail height* sebesar 24.17 m yang disederhanakan unutk perancangan menjadi 25 m. Dari Tabel 4.29 juga dapat diketahui lebar *runway strips* termasuk landasan denga tipe landasan instrument untuk pesawat A380 tipe F adalah 300 m.



Gambar 4. 5 General Aircraft Dimensions A380
(Sumber: Airport Planning Manual for A380 Series, 2005)

Dari spesifikasi dan persyaratan yang telah ada maka dapat diperoleh jarak minimum horizontal antara *runway* dan apron adalah ½ dari lebar *runway strip* termasuk landasan ditambah dengan tujuh kali *tail height*. Adapun rumusan jarak horizontal minimum antara *runway* dan apron adalah sebagai berikut.

$$L = \frac{1}{2}.Ws + 7.ht \qquad (4.7)$$

dimana:

L = jarak horizontal minimum (m)
Ws = Lebar *runway strips* untuk pesawat tipe F (m)
Ht = *tail height* (m)

Berikut merupakan perhitungan jarak horizontal minimum yang digunakan sebagai dasar perancangan dalam perhitungan penambahan tingkat konsumsi bahan bakar pesawat.

Data diketahui:

- Ws = 300 m
- ht = 24,17 ~ 25 m

$$L = \frac{1}{2}.Ws + 7.ht$$

= ½ x 300 + 7 x 25

= 325 m

d. Jenis Engine dan Jumlah Engine

Dalam perhitungan tingkat pertambahan konsumsi bahan bakar juga diperlukan tipe mesin pesawat yang diaplikasikan setiap tipe pesawat. Tipe *Jet engine* ini juga akan berpengaruh terhadap berapa kemampuan gaya *thrust* dan tingkat konsumsi bahan bahan bakarnya.

e. Engine Spesific Fuel Consumption

Specific fuel consumption adalah rasio perbandingan total konsumsi bahan bakar terhadap gaya dorong (*thrust*) yang dihasilkan dari *jet engine* setiap tipe pesawat. Nilai SFC memiliki nilai yang berbeda-beda tergantung dari jenis mesin yang digunakan. *Spesific fuel consumption* ini dinyatakan dengan satuan lbs/lbf/h untuk mesin turbojet dan turbofan sedangkan lbf/shp/h untuk mesin turboprop. Nilai SFC ini dapat diperoleh dari jet engine katalog keluarin industri mesin propulsi seperti Avco, CFM, Rolls Royce, General Electric, dan Pratt and Whitney serta industri propulsi lainnya.

4.4.2 Perhitungan Kecepatan Taxiing

Untuk perhitungan kecepatan dalam *taxiing*, digunakan rumusan yang sama pada pembahasan sebelumnya. Dalam pembatasan kecepatan ini digunakan nilai kecepatan antara 10 knot hingga 20 knot seperti pada bahasan seblumnya (5,2 m/s hingga 10,3 m/s). Berdasarkan perhitungan kecepatan pada analisa kecepatan *taxiing* pada pembahasan sebelumnya diperoleh besar kecepatan yang berbeda-beda tergantung dari jenis pesawat. Akan tetapi untuk menganalisis pertambahan bahan bakar, jika kecepatan *taxiing* sama dengan atau lebih besar dari kecepatan syarat minimum maka kecepatan yang akan digunakan adalah kecepatan syarat minimum yaitu 5,2 m/s atau setara dengan 10 knots (Vcalculate ≥ Vmin → Vapp = 5,2 m/s). Hal ini agar hasil analisis dan perhitungan kebutuhan konsumsi bahan bakar yang digunakan dapat diperoleh hasil seminimal mungkin. Dalam Tabel 4.33 disajikan rekapitulasi hasil perhitugan kecepatan dengan gradien yang berbeda-beda.

Tabel 4. 34 Rekapitulasi Perhitungan Kecepatan dan Kecepatan Rencana

No	Jenis Pesawat	Vcalculate g = 0,5° (m/s)	Vcalculate g = 1° (m/s)	Vcalculate g = 1,5° (m/s)	Vcalculate g = 2° (m/s)	Kecepatan yang digunakan (Vapplicate) (m/s)
1	DC-9-15	29,444	14.723	9,816	7,365	5,2
2	DC-10-40	31,594	15.798	10,533	7,900	5,2
3	MD-11 Freighter	33,176	8.251	11,059	8,295	5,2
4	B739ER	29,822	14.911	9,942	7,457	5,2
5	B748	33,216	16.609	11,073	8,305	5,2
6	B753	32,677	16.339	10,893	8,171	5,2
7	B773ER	34,354	17.173	11,452	8,590	5,2
8	A339	27,993	13.997	9,332	6,999	5,2
9	A359	31,937	15.969	10,647	7,986	5,2
10	A388	27,625	13.813	9,209	6,907	5,2

4.4.3 Perhitungan Gaya Thrust

Untuk menganalisa tingkat pertambahan penggunaan bahan bakar pesawat pada *runway* dan ujung *taxiway* yang memiliki beda tinggi, terlebih dahulu harus diperhitungkan sebuah acuan dalam perhitungan. Acuan yang digunakan untuk memperhitungkan pertambahan tingkat konsumsi bahan bakar adalah kondisi dimana *runway* dan ujung *taxiway* tidak memiliki perbedaaan tinggi (datar) atau gradien = 0.

Dari hasil penjabaran variabel apa saja yang berpengaruh terhadap pertambahan penggunaan bahan bakar, maka digunakanlah rumusan energi mekanik sebagai rumusan dasar analisa. Rumusan mekanik ini nantinya akan menghasilkan besaran gaya *thrust* yang akan dikeluarkan oleh engine pesawat akibat adanya perbedaan tinggi antara *runway* dan ujung *exit taxiway*. Adapun rumusan energi mekanik tersebut dirumuskan sebagai berikut.

$$\frac{1}{2}mv^2 + mgh + f.s = F_{thrust}.s \qquad (4.8)$$

$$F_{thrust} = \frac{1/2mv^2+mgh+f.s}{s} \qquad (4.9)$$

dimana:

F_{thrust}	= gaya thrust yang dihasilkan (lbf)
m	= berat maksimum pendaratan (kg)
v	= kecepatan *taxiing* (m/s)
g	= percepatan gravitasi (9.81 m/s^2)
h	= ketinggian (m)
f	= gaya friksi perkerasan (N)
	= $mg \sin \theta . \mu$
θ	= kemiringan gradien (°)
μ	= 0.34
s	= jarak *runway* ke ujung *taxiway* (m)

Dengan menggunakan rumusan (4.8) akan diperhitungkan gaya thrust yang dibutuhkan untuk pesawat berjalan dari *runway* hingga ke ujung *taxiway*. Untuk perancangan gradien yang digunakan dalam perhitungan tingkat pertambahan konsumsi bahan bakar ini akan diperhitungkan hingga gradien maksimum adalah 2 derajat (g = 2°).

Nilai g = 2° digunakan sebagai gradien maksimum karena berdasarkan perhitungan kecepatan pada bahasan sebelumnya, pesawat mampu berjalan di *exit taxiway* dengan kecepatan yang diisyaratkan, maksimum hingga perbedaan tinggi atau gradien 2 derajat. Adapun contoh perhitungan tiap gradien gaya *thrust* yang dibutuhkan dijabarkan dalam poin-poin dibawah ini, dimana contoh pesawat yang digunakan sebagai contoh perhitungan adalah pesawat Boeing 737-900ER.

a. Gradien = 0° (g = 0 %)
   Data diketahui:
   - Jenis Pesawat = Boeing 737-900ER
   - Tipe Mesin = CFM56-7B27
   - e = 0.75
   - n = 2
   - F = 27300 lbf
   - m_{mlw} = 71350 kg
   - θ = 0°
   - V = 5,2 m/s
   - g = 9,81 m/s^2
   - L horizontal = 325 m

   Jarak bidang vertical (ketinggian):
   $h = tan\theta . L_{horizontal}$
   $= \tan 0 \,.\, 325$
   $= 0$ m

Jarak bidang diagonal:

$$s = \sqrt{h^2 + L^2}$$
$$= \sqrt{0^2 + 325^2}$$
$$= 325 \text{ m}$$

Gaya gesekan perkerasan:

$$f = mg.sin\theta.\mu$$
$$= 71350x9{,}81.sin\theta.0{,}34$$
$$= 0 \text{ Newton}$$

Gaya thrust yang dihasilkan:

$$F_{thrust} = \frac{1/2mv^2+mgh+f.s}{s}$$
$$= \frac{1/2x71350x5{,}2^2 + 71350x9{,}81x0 + 0x325}{325}$$
$$= 2968{,}16 \text{ N}$$
$$= 667{,}242368 \text{ lbf}$$

Dalam Tabel 4.35 disajikan rekapitulasi hasil perhitugan gaya thrust untuk tipe pesawat yang berbeda-beda.

Tabel 4. 35 Rekapitulasi Perhitungan Gaya Thrust Tiap Tipe Pesawat Gradien 0°

No	Jenis Pesawat	MLW (Kg)	V (m/s)	Jarak Vertikal (m)	Jarak Diagonal (m)	Gaya Gesekan Perkerasan (N)	Gaya Thrust (lbf)
1	DC-9-15	37059	5,2	0	325	0	346.5639
2	DC-10-40	182798	5,2	0	325	0	1709.4684
3	MD-11 Freighter	213872	5,2	0	325	0	2000.0625
4	B739ER	66814	5,2	0	325	0	667.2423
5	B748	312072	5,2	0	325	0	2918.3974
6	B753	101610	5,2	0	325	0	950.224
7	B773ER	251290	5,2	0	325	0	2349.9837
8	A339	191000	5,2	0	325	0	1786.1709
9	A359	205000	5,2	0	318	0	1917.0944
10	A388	390000	5,2	0	318	0	3693.9136

b. Gradien = 0.5° (g = 0,87 %)
Data diketahui:

- Jenis Pesawat = Boeing 737-900ER
- Tipe Mesin = CFM56-7B27
- e = 0.75
- n = 2
- F = 27300 lbf
- m_{mlw} = 71350 kg
- θ = 0,5°
- V = 5,2 m/s
- g = 9,81 m/s^2
- L horizontal = 325 m

Jarak bidang vertical (ketinggian):

$h = tan\theta . L_{horizontal}$
$= \tan 0{,}5 \,.\, 325$
$= 2{,}836$ m

Jarak bidang diagonal:

$s = \sqrt{h^2 + L^2}$
$= \sqrt{2{,}836^2 + 325^2}$
$= 325{,}0124$ m

Gaya gesekan perkerasan:

$f = mg . sin\theta . \mu$
$= 71350x9{,}81 . sin 0{,}5.0{,}34$
$= 2076{,}748$ Newton

Gaya thrust yang dihasilkan:

$$F_{thrust} = \frac{1/2mv^2 + mgh + f.s}{s}$$

$$= \frac{1/2x71350x5{,}2^2 + 71350x9{,}81x2{,}836 + 2076{,}748x325{,}0124}{325{,}0124}$$

= 9094,922 N
= 2044,538 lbf

Dalam Tabel 4.36 disajikan rekapitulasi hasil perhitugan gaya thrust untuk tipe pesawat yang berbeda-beda.

Tabel 4. 36 Rekapitulasi Perhitungan Gaya Thrust Tiap Tipe Pesawat Gradien 0,5°

No	Jenis Pesawat	MLW (Kg)	V (m/s)	Jarak Vertikal (m)	Jarak Diagonal (m)	Gaya Gesekan Perkerasan (N)	Gaya Thrust (lbf)
1	DC-9-15	37059	5,2	2,836	325,0124	1078.657283	1061.927854
2	DC-10-40	182798	5,2	2,836	325,0124	5320.607519	5238.087584
3	MD-11 Freighter	213872	5,2	2,836	325,0124	6225.062481	6128.514906
4	B739ER	66814	5,2	2,836	325,0124	2076.747812	2044.538502
5	B748	312072	5,2	2,836	325,0124	9083.319455	8942.441759
6	B753	101610	5,2	2,836	325,0124	2957.510093	2911.640606
7	B773ER	251290	5,2	2,836	325,0124	7314.168993	7200.729926
8	A339	191000	5,2	2,836	325,0124	5559.338922	5473.116383
9	A359	205000	5,2	2,836	325,0124	5966.829733	5874.287218
10	A388	390000	5,2	2,836	325,0124	11497.06217	11318.74854

c. Gradien = 1° (g = 1,75 %)
Data diketahui:

- Jenis Pesawat = Boeing 737-900ER
- Tipe Mesin = CFM56-7B27
- e = 0.75
- n = 2
- F = 27300 lbf
- m_{mlw} = 71350 kg
- θ = 1°
- V = 5,2 m/s
- g = 9,81 m/s^2
- L horizontal = 325 m

Jarak bidang vertical (ketinggian):

$h = tan\theta . L_{horizontal}$

$= \tan 1 . 325$

$= 5{,}6729$ m

Jarak bidang diagonal:

$$s = \sqrt{h^2 + L^2}$$
$$= \sqrt{5{,}6729^2 + 325^2}$$
$$= 325{,}0495 \text{ m}$$

Gaya gesekan perkerasan:

$$f = mg.sin\theta.\mu$$
$$= 71350x9{,}81.sin1.0{,}34$$
$$= 4153{,}337 \text{ Newton}$$

Gaya thrust yang dihasilkan:

$$F_{thrust} = \frac{1/2mv^2 + mgh + f.s}{s}$$

$$= \frac{1/2x71350x5{,}2^2 + 71350x9{,}81x5{,}6729 + 4153{,}337x325{,}0495}{325{,}0495}$$

= 15220.98742 N
= 3421.677972 lbf

Dalam Tabel 4.37 disajikan rekapitulasi hasil perhitugan gaya thrust untuk tipe pesawat yang berbeda-beda.

Tabel 4. 37 Rekapitulasi Perhitungan Gaya Thrust Tiap Tipe Pesawat Gradien 1°

No	Jenis Pesawat	MLW (Kg)	V (m/s)	Jarak Vertikal (m)	Jarak Diagonal (m)	Gaya Gesekan Perkerasan (N)	Gaya Thrust (lbf)
1	DC-9-15	37059	5,2	5,6729	325,0495	2157.232423	1777.210427
2	DC-10-40	182798	5,2	5,6729	325,0495	10640.80985	8766.305395
3	MD-11 Freighter	213872	5,2	5,6729	325,0495	12449.6509	10256.4977
4	B739ER	66814	5,2	5,6729	325,0495	4153.337471	3421.677972
5	B748	312072	5,2	5,6729	325,0495	18165.94718	14965.80081
6	B753	101610	5,2	5,6729	325,0495	5914.794961	4872.8339
7	B773ER	251290	5,2	5,6729	325,0495	14627.78098	12050.92442
8	A339	191000	5,2	5,6729	325,0495	11118.25448	9159.642504
9	A359	205000	5,2	5,6729	325,0495	11933.20507	9831.029912
10	A388	390000	5,2	5,6729	325,0495	22993.24879	18942.71617

d. Gradien = 1.5° (g = 2,6 %)
Data diketahui:

- Jenis Pesawat = Boeing 737-900ER
- Tipe Mesin = CFM56-7B27
- e = 0.75
- n = 2
- F = 27300 lbf
- m_{mlw} = 71350 kg
- θ = 1,5°
- V = 5,2 m/s
- g = 9,81 m/s^2
- L horizontal = 325 m

Jarak bidang vertical (ketinggian):

$h = tan\theta . L_{horizontal}$

$= \tan 1{,}5 \,.\, 318$

$= 8{,}5104$ m

Jarak bidang diagonal:

$s = \sqrt{h^2 + L^2}$

$= \sqrt{8{,}5104^2 + 325^2}$

$= 325{,}1114$ m

Gaya gesekan perkerasan:

$f = mg . sin\theta . \mu$

$= 71350x9{,}81 . sin\theta . 0{,}34$

$= 6229{,}611$ Newton

Gaya thrust yang dihasilkan:

$$F_{thrust} = \frac{1/2mv^2 + mgh + f.s}{s}$$

$$= \frac{1/2x71350x5{,}2^2 + 71350x9{,}81x8{,}5104 + 6229{,}611x325{,}1114}{325{,}1114}$$

= 21345.884 N
= 4798.555 lbf

Dalam Tabel 4.38 disajikan rekapitulasi hasil perhitugan gaya thrust untuk tipe pesawat yang berbeda-beda.

Tabel 4. 38 Rekapitulasi Perhitungan Gaya Thrust Tiap Tipe Pesawat Gradien 1,5°

No	Jenis Pesawat	MLW (Kg)	V (m/s)	Jarak Vertikal (m)	Jarak Diagonal (m)	Gaya Gesekan Perkerasan (N)	Gaya Thrust (lbf)
1	DC-9-15	37059	5,2	8,5104	325,1114	3235.64328	2492.356656
2	DC-10-40	182798	5,2	8,5104	325,1114	15960.20185	12293.85067
3	MD-11 Freighter	213872	5,2	8,5104	325,1114	18673.29123	14383.69365
4	B739ER	66814	5,2	8,5104	325,1114	6229.610838	4798.554938
5	B748	312072	5,2	8,5104	325,1114	27247.1915	20988.01172
6	B753	101610	5,2	8,5104	325,1114	8871.629394	6833.65336
7	B773ER	251290	5,2	8,5104	325,1114	21940.27901	16900.1944
8	A339	191000	5,2	8,5104	325,1114	16676.32334	12845.46592
9	A359	205000	5,2	8,5104	325,1114	17898.67164	13787.01839
10	A388	390000	5,2	8,5104	325,1114	34487.68439	26565.23056

e. Gradien = 2° (g = 3,5 %)
Data diketahui:

- Jenis Pesawat = Boeing 737-900ER
- Tipe Mesin = CFM56-7B27
- e = 0.75
- n = 2
- F = 27300 lbf
- m_{mlw} = 71350 kg
- θ = 2°
- V = 5,2 m/s
- g = 9,81 m/s^2
- L horizontal = 325 m

Jarak bidang vertical (ketinggian):

$h = tan\theta . L_{horizontal}$

$= \tan 0{,}5 \,.\, 318$

$= 11{,}349$ m

Jarak bidang diagonal:

$$s = \sqrt{h^2 + L^2}$$
$$= \sqrt{11{,}349^{\,2} + 325^2}$$
$$= 325{,}1981 \text{ m}$$

Gaya gesekan perkerasan:

$$f = mg.sin\theta.\mu$$
$$= 71350x9{,}81.sin2.0{,}34$$
$$= 8305{,}41 \text{ Newton}$$

Gaya thrust yang dihasilkan:

$$F_{thrust} = \frac{1/2mv^2 + mgh + f.s}{s}$$

$$= \frac{1/2x71350x5{,}2^2 + 71350x9{,}81x11{,}495 + 8305{,}41x325{,}1981}{325{,}1981}$$

= 27469.144 N

= 6175.064 lbf

Dalam Tabel 4.39 disajikan rekapitulasi hasil perhitugan gaya thrust untuk tipe pesawat yang berbeda-beda.

Tabel 4. 39 Rekapitulasi Perhitungan Gaya Thrust Tiap Tipe Pesawat Gradien 2°

No	Jenis Pesawat	MLW (Kg)	V (m/s)	Jarak Vertikal (m)	Jarak Diagonal (m)	Gaya Gesekan Perkerasan (N)	Gaya Thrust (lbf)
1	DC-9-15	37059	5,2	11,349	325,1981	4313.807731	3207.31158
2	DC-10-40	182798	5,2	11,349	325,1981	21278.37841	15820.45231
3	MD-11 Freighter	213872	5,2	11,349	325,1981	24895.50951	18509.78554
4	B739ER	66814	5,2	11,349	325,1981	8305.409796	6175.06358
5	B748	312072	5,2	11,349	325,1981	36326.36084	27008.61166
6	B753	101610	5,2	11,349	325,1981	11827.78822	8793.948289
7	B773ER	251290	5,2	11,349	325,1981	29251.1062	21748.16716
8	A339	191000	5,2	11,349	325,1981	22233.12223	16530.30335
9	A359	205000	5,2	11,349	325,1981	23862.77517	17741.94862
10	A388	390000	5,2	11,349	325,1981	45979.49361	34185.70588

4.4.4 Perhitungan Tingkat Konsumsi Bahan Bakar

Setelah besar gaya thrust yang dibutuhkan untuk pesawat berjalan pada *exit taxiway* dengan gradien tertentu diperoleh, langkah selanjutnya adalah memperhitungkan tingkat penggunaan bahan bakar avtur pada tiap gradien rencana. Dalam perhitungan bahan bakar ini akan digunakan variabel specific *fuel consumption* dari setiap mesin pesawat untuk mencari nilai dari bahan bakar yang digunakan yang dinyatakan dalm satuan pounds (lbs). Analisa dan perhitungan tingkat konsumsi bahan bakar tiap pesawat ini menggunakan rumusan sebagai berikut.

$$M_{fc} = F_{thrust} . SFC . t \quad (4.10)$$

$$t = \frac{s}{V} \quad (4.11)$$

keterangan:

M_{fc} = konsumsi bahan bakar (lb)
F_{thrust} = gaya *thrust* yang dihasilkan (lbf)
SFC = *Spesific Fuel Consumption* (lb/lbf/h)
t = waktu tempuh pesawat di *taxiway* (s/h)
s = jarak *runway* ke ujung *taxiway* (m)
v = kecepatan *taxiing* (m/s)

Dengan persamaan tersebut maka dapat diperhitungkan tingkat pertambahan konsumsi bahan bakar. Perhiutngan pertambahan bahan bakar dengan perbedaan pada besarnya gradien adalah sebagai berikut.

a. Gradien = 0° (g = 0 %)

Data diketahui:

- Jenis Pesawat = Boeing 737-900ER
- Tipe Mesin = CFM56-7B27
- F_{thrust} = 691,6373 lbf
- SFC = 0,38 lb/lbf/h
- s = 318 m
- v = 5,2 m/s
- g = 0°

Waktu tempuh pesawat di *taxiway*:

$t = \frac{s}{V}$

$= \frac{318}{5,2}$

= 62,5 seconds ~ 0.001444 hour

Konsumsi bahan bakar:

$M_{fc} = F_{thrust} \,.SFC.t$

$= 667,242368 \,.0,38.0,001444$

$= 4,401946 \; lb$

Dengan cara yang sama dapat diperoleh nilai konsumsi bahan bakar tiap pesawat untuk melewati *exit taxiway* dengan gradien 0°. Adapun rekapitulasi perhitungan jumlah konsumsi bahan bakar untuk tiap pesawat dengan gradien 0° ditunjukkan dalam Tabel 4.40.

Tabel 4. 40 Rekapitulasi Perhitungan Tingkat Konsumsi Bahan Bakar Tiap Tipe Pesawat Gradien 0°

No	Jenis Pesawat	Tipe Mesin	Gaya Thrust (lbf)	SFC (lb/lbf/h)	V (m/s)	Jarak Diagonal (m)	Konsumsi Bahan Bakar (lb)
1	DC-9-15	P&W JT8D-7	346.5639	0,585	5,2	325	3.5197897
2	DC-10-40	P&W JT9D-20	1709.4684	0,37	5,2	325	10.98096
3	MD-11 Freighter	CF6-80C2D1F	2000.0625	0,322	5,2	325	11.1809
4	B739ER	CFM56-7B27	667.2423	0,38	5,2	325	4.40194
5	B748	GEnx-2B67B	2918.3974	0,324	5,2	325	16.4159
6	B753	P&W PW2043	950.224	0,35	5,2	325	5.7739
7	B773ER	GE90-110B1	2349.9837	0,324	5,2	325	13.2186
8	A339	P&W PW4168A	1786.1709	0,323	5,2	325	10.0162
9	A359	Trent XWB-84	1917.0944	0,45	5,2	325	14.9773
10	A388	Engine Alliance GP7270	3693.9136	0,38	5,2	325	24.369

b. Gradien = 0,5° (g = 0,87 %)

Dengan cara yang sama pada poin A dapat diperoleh nilai konsumsi bahan bakar tiap pesawat untuk melewati *exit taxiway* dengan gradien 0,5°. Adapun rekapitulasi perhitungan jumlah konsumsi bahan bakar untuk tiap pesawat dengan gradien 0,5° ditunjukkan dalam Tabel 4.40.

Tabel 4. 41 Rekapitulasi Perhitungan Tingkat Konsumsi Bahan Bakar Tiap Tipe Pesawat Gradien 0,5°

No	Jenis Pesawat	Tipe Mesin	Gaya Thrust (lbf)	SFC (lb/lbf/h)	V (m/s)	Jarak Diagonal (m)	Konsumsi Bahan Bakar (lb)
1	DC-9-15	P&W JT8D-7	1061.927854	0,585	5,2	325,0124	10.78561545
2	DC-10-40	P&W JT9D-20	5238.087584	0,37	5,2	325,0124	33.64871885
3	MD-11 Freighter	CF6-80C2D1F	6128.514906	0,322	5,2	325,0124	34.26140526
4	B739ER	CFM56-7B27	2044.538502	0,38	5,2	325,0124	13.48878845
5	B748	GEnx-2B67B	8942.441759	0,324	5,2	325,0124	50.30315028
6	B753	P&W PW2043	2911.640606	0,35	5,2	325,0124	17.69293432
7	B773ER	GE90-110B1	7200.729926	0,324	5,2	325,0124	40.50564817
8	A339	P&W PW4168A	5473.116383	0,323	5,2	325,0124	30.69242895
9	A359	Trent XWB-84	5874.287218	0,45	5,2	325,0124	45.89461641
10	A388	Engine Alliance GP7270	11318.74854	0,38	5,2	325,0124	74.6751428

c. Gradien = 1° (g = 1,75 %)

Dengan cara yang sama pada poin A dapat diperoleh nilai konsumsi bahan bakar tiap pesawat untuk melewati *exit taxiway* dengan gradien 1°. Adapun rekapitulasi perhitungan jumlah konsumsi bahan bakar untuk tiap pesawat dengan gradien 1° ditunjukkan dalam Tabel 4.41.

Tabel 4. 42 Rekapitulasi Perhitungan Tingkat Konsumsi Bahan Bakar Tiap Tipe Pesawat Gradien 1°

No	Jenis Pesawat	Tipe Mesin	Gaya Thrust (lbf)	SFC (lb/lbf/h)	V (m/s)	Jarak Diagonal (m)	Konsumsi Bahan Bakar (lb)
1	DC-9-15	P&W JT8D-7	1777.210427	0,585	5,2	325,0495	18.05254289
2	DC-10-40	P&W JT9D-20	8766.305395	0,37	5,2	325,0495	56.31991453
3	MD-11 Freighter	CF6-80C2D1F	10256.4977	0,322	5,2	325,0495	57.34540518
4	B739ER	CFM56-7B27	3421.677972	0,38	5,2	325,0495	22.57700854
5	B748	GEnx-2B67B	14965.80081	0,324	5,2	325,0495	84.19545295
6	B753	P&W PW2043	4872.8339	0,35	5,2	325,0495	29.61374408
7	B773ER	GE90-110B1	12050.92442	0,324	5,2	325,0495	67.79677566
8	A339	P&W PW4168A	9159.642504	0,323	5,2	325,0495	51.37179169
9	A359	Trent XWB-84	9831.029912	0,45	5,2	325,0495	76.81662073
10	A388	Engine Alliance GP7270	18942.71617	0,38	5,2	325,0495	124.9883444

d. Gradien = 1,5° (g = 2,6 %)

Dengan cara yang sama pada poin A dapat diperoleh nilai konsumsi bahan bakar tiap pesawat untuk melewati *exit taxiway* dengan gradien 1,5°. Adapun rekapitulasi perhitungan jumlah konsumsi bahan bakar untuk tiap pesawat dengan gradien 1,5° ditunjukkan dalam Tabel 4.42.

Tabel 4. 43 Rekapitulasi Perhitungan Tingkat Konsumsi Bahan Bakar Tiap Tipe Pesawat Gradien 1,5°

No	Jenis Pesawat	Tipe Mesin	Gaya Thrust (lbf)	SFC (lb/lbf/h)	V (m/s)	Jarak Diagonal (m)	Konsumsi Bahan Bakar (lb)
1	DC-9-15	P&W JT8D-7	2492.356656	0,585	5,2	325,1114	25.3216744
2	DC-10-40	P&W JT9D-20	12293.85067	0,37	5,2	325,1114	78.99798641
3	MD-11 Freighter	CF6-80C2D1F	14383.69365	0,322	5,2	325,1114	80.4364065
4	B739ER	CFM56-7B27	4798.554938	0,38	5,2	325,1114	31.6679851
5	B748	GEnx-2B67B	20988.01172	0,324	5,2	325,1114	118.0980352
6	B753	P&W PW2043	6833.65336	0,35	5,2	325,1114	41.53816944
7	B773ER	GE90-110B1	16900.1944	0,324	5,2	325,1114	95.09618057
8	A339	P&W PW4168A	12845.46592	0,323	5,2	325,1114	72.05742649
9	A359	Trent XWB-84	13787.01839	0,45	5,2	325,1114	107.7480037
10	A388	Engine Alliance GP7270	26565.23056	0,38	5,2	325,1114	175.3168061

e. Gradien = 2° (g = 3,5 %)

Dengan cara yang sama pada poin A dapat diperoleh nilai konsumsi bahan bakar tiap pesawat untuk melewati *exit taxiway* dengan gradien 2°. Adapun rekapitulasi perhitungan jumlah konsumsi bahan bakar untuk tiap pesawat dengan gradien 2° ditunjukkan dalam Tabel 4.43.

Tabel 4. 44 Rekapitulasi Perhitungan Tingkat Konsumsi Bahan Bakar Tiap Tipe Pesawat Gradien 2°

No	Jenis Pesawat	Tipe Mesin	Gaya Thrust (lbf)	SFC (lb/lbf/h)	V (m/s)	Jarak Diagonal (m)	Konsumsi Bahan Bakar (lb)
1	DC-9-15	P&W JT8D-7	3207.31158	0,585	5,2	325,1981	32.594
2	DC-10-40	P&W JT9D-20	15820.45231	0,37	5,2	325,1981	101.686
3	MD-11 Freighter	CF6-80C2D1F	18509.78554	0,322	5,2	325,1981	103.538
4	B739ER	CFM56-7B27	6175.06358	0,38	5,2	325,1981	40.763
5	B748	GEnx-2B67B	27008.61166	0,324	5,2	325,1981	152.016
6	B753	P&W PW2043	8793.948289	0,35	5,2	325,1981	53.468
7	B773ER	GE90-110B1	21748.16716	0,324	5,2	325,1981	122.408
8	A339	P&W PW4168A	16530.30335	0,323	5,2	325,1981	92.752
9	A359	Trent XWB-84	17741.94862	0,45	5,2	325,1981	138.693
10	A388	Engine Alliance GP7270	34185.70588	0,38	5,2	325,1981	225.668

4.4.5 Perhitungan Biaya Pertambahan Konsumsi Bahan Bakar

Untuk mengetahui signifikan atau tidaknya akibat dari adanya perbedaan tinggi antara *runway* dan ujung *exit taxiway* maka akan dihitung pertambahan biaya akibat konsumsi bahan bakar yang bertambah. Dalam point bahasan sebelumnya sudah diperhitungkan jumlah bahan bakar yang diperlukan untuk gradien yang berbeda. Tahapan selanjutnya adalah memperhitungkan jumlah biaya akibat dari pertambahan bahan bakar tersebut dengan mengalikan jumlah bahan bakar hasil perhitungan dengan harga satuan dari bahan bakar. Jenis bahan bakar yang digunakan disini adalah bahan bakar avtur jenis A-1 dengan harga satuan yang diambil dari website resmi pertamina untuk penerbangan sipil yaitu www.aviation.pertamina.com. Harga yang digunakan berdasarkan publikasi resmi dari Pertamina dapat berubah tergantung tempat operasi bandar udara. Harga satuan yang digunakan dalam perhitungan diambil secara acak misalnya saja pada Tugas Akhir ini digunakan lokasi bandar udara Adisutjipto Yogyakarta. Harga satuan untuk Bandara Adisutjipto Yogyakarta ditampilkan dalam Gambar 4.6 yang dijadikan sebagai dasar perhitungan.

Gambar 4. 6 Harga Satuan Avtur Tipe Jet A-1 Pertamina
(Sumber: www.aviation.pertamina.com, 2018)

Berdasarkan harga dari PT. Pertamina diperoleh harga bahan bakar avtur tipe Jet A-1 adalah Rp 9.630,00 per liter. Karena harga yang tercantum dalam satuan per liter sedangkan nilai konsumsi bahan bakar yang telah diperhitungkan pada pembahasan sebelumnya memiliki satuan pounds (lbs) maka jumlah berat konsumsi bahan bakar yang sudah diperhitungkan perlu dikonversi ke dalam satuan liter. Setelah diperoleh jumlah konsumsi bahan bakar dalam satuan liter, kemudian hasil tersebut akan dikalikan dengan harga satuan yang telah ditetapkan. Adapun rumusan yang digunakan dalam perhitungan harga konsumsi bahan bakar yang digunakan adalah sebagai berikut.

$$V_{fc} = \frac{Mfc}{\rho_{avtur}} \tag{4.12}$$

$$N_{fc} = V_{fc}.HS_{avtur} \tag{4.13}$$

keterangan:

V_{fc} = volume konsumsi bahan bakar (liter)
M_{fc} = berat konsumsi bahan bakar (lbs)
ρ_{avtur} = massa jenis avtur(0,804 kg/L= 1,7725 lbs/L)
N_{fc} = harga total penggunaan bahan bakar (Rp)
HS_{avtur} = harga satuan avtur per liter (Rp 9630,-/L)

Berikut merupakan contoh perhitungan jumlah harga konsumsi bahan bakar untuk pesawat tipe Boeing 737-900ER.

a. Gradien 0° (g = 0 %)

Data diketahui:

- Jenis Pesawat = Boeing 737-900ER
- M_{fc} = 4,4019 lbs
- ρ_{avtur} = 1,7725 lbs/L
- HS_{avtur} = Rp 9630,-/L

Volume konsumsi bahan bakar:

$$V_{fc} = \frac{Mfc}{\rho_{avtur}}$$

$$= \frac{4{,}4019}{1{,}7725}$$

= 2,48344 L

Konsumsi bahan bakar:

$$N_{fc} = V_{fc} \,.\, HS_{avtur}$$

$$= 2{,}483 \,.\, Rp\ 9.630,-$$

$$= Rp\ 23.915{,}60,-$$

Dari hasil perhtitungan dengan menggunakan cara dan rumusan yang sama maka dapat diperoleh rekapitulasi jumlah harga untuk tipe pesawat yang berbeda untuk gradien 0° yang ditampilkan pada Tabel 4.45.

Tabel 4. 45 Rekapitulasi Perhitungan Harga Konsumsi Bahan Bakar Gradien 0°

No	Jenis Pesawat	Berat Konsumsi Bahan Bakar (lbs)	Massa Jenis Avtur (lbs/L)	Harga Satuan Avtur (per L)	Jumlah Harga
1	DC-9-15	3.5197897	1,7725	Rp 9630,-	Rp 19,122.88
2	DC-10-40	10.98096			Rp 59,659.12
3	MD-11 Freighter	11.1809			Rp 60,745.41
4	B739ER	4.40194			Rp 23,915.60
5	B748	16.4159			Rp 89,187.39
6	B753	5.7739			Rp 31,369.54
7	B773ER	13.2186			Rp 71,816.44
8	A339	10.0162			Rp 54,417.62
9	A359	14.9773			Rp 81,371.07
10	A388	24.369			Rp 132,398.89

b. Gradien 0,5° (g = 0,87 %)

Dari hasil perhtitungan dengan menggunakan cara dan rumusan yang sama maka dapat diperoleh rekapitulasi jumlah harga untuk tipe pesawat yang berbeda untuk gradien 0,5° yang ditampilkan pada Tabel 4.46.

Tabel 4. 46 Rekapitulasi Perhitungan Harga Konsumsi Bahan Bakar Gradien 0,5°

No	Jenis Pesawat	Berat Konsumsi Bahan Bakar (lbs)	Massa Jenis Avtur (lbs/L)	Harga Satuan Avtur (per L)	Jumlah Harga
1	DC-9-15	10.78561545	1,7725	Rp 9630,-	Rp 58,597.82
2	DC-10-40	33.64871885			Rp 182,812.14
3	MD-11 Freighter	34.26140526			Rp 186,140.84
4	B739ER	13.48878845			Rp 73,284.05
5	B748	50.30315028			Rp 273,295.00
6	B753	17.69293432			Rp 96,125.00
7	B773ER	40.50564817			Rp 220,065.56
8	A339	30.69242895			Rp 166,750.73
9	A359	45.89461641			Rp 249,343.61
10	A388	74.6751428			Rp 405,707.05

c. Gradien 1° (g = 1,75 %)

Dari hasil perhtitungan dengan menggunakan cara dan rumusan yang sama maka dapat diperoleh rekapitulasi jumlah harga untuk tipe pesawat yang berbeda untuk gradien 1° yang ditampilkan pada Tabel 4.46.

Tabel 4. 47 Rekapitulasi Perhitungan Harga Konsumsi Bahan Bakar Gradien 1°

No	Jenis Pesawat	Berat Konsumsi Bahan Bakar (lbs)	Massa Jenis Avtur (lbs/L)	Harga Satuan Avtur (per L)	Jumlah Harga
1	DC-9-15	18.05254289	1,7725	Rp 9630,-	Rp 98,078.74
2	DC-10-40	56.31991453			Rp 305,983.83
3	MD-11 Freighter	57.34540518			Rp 311,555.28
4	B739ER	22.57700854			Rp 122,659.98
5	B748	84.19545295			Rp 457,430.52
6	B753	29.61374408			Rp 160,890.28
7	B773ER	67.79677566			Rp 368,337.16
8	A339	51.37179169			Rp 279,100.88
9	A359	76.81662073			Rp 417,341.62
10	A388	124.9883444			Rp 679,056.66

d. Gradien 1,5° (g = 2,6 %)

Dari hasil perhtitungan dengan menggunakan cara dan rumusan yang sama maka dapat diperoleh rekapitulasi jumlah harga untuk tipe pesawat yang berbeda untuk gradien 0° yang ditampilkan pada Tabel 4.48.

Tabel 4. 48 Rekapitulasi Perhitungan Harga Konsumsi Bahan Bakar Gradien 1,5°

No	Jenis Pesawat	Berat Konsumsi Bahan Bakar (lbs)	Massa Jenis Avtur (lbs/L)	Harga Satuan Avtur (per L)	Jumlah Harga
1	DC-9-15	25.3216744	1,7725	Rp 9630,-	Rp 137,571.64
2	DC-10-40	78.99798641			Rp 429,192.89
3	MD-11 Freighter	80.4364065			Rp 437,007.77
4	B739ER	31.6679851			Rp 172,050.89
5	B748	118.0980352			Rp 641,621.88
6	B753	41.53816944			Rp 225,675.21
7	B773ER	95.09618057			Rp 516,653.73
8	A339	72.05742649			Rp 391,485.10
9	A359	107.7480037			Rp 585,390.58
10	A388	175.3168061			Rp 952,489.17

e. Gradien 2° (g = 3,5 %)

Dari hasil perhtitungan dengan menggunakan cara dan rumusan yang sama maka dapat diperoleh rekapitulasi jumlah harga untuk tipe pesawat yang berbeda untuk gradien 0° yang ditampilkan pada Tabel 4.49.

Tabel 4. 49 Rekapitulasi Perhitungan Harga Konsumsi Bahan Bakar Gradien 2°

No	Jenis Pesawat	Berat Konsumsi Bahan Bakar (lbs)	Massa Jenis Avtur (lbs/L)	Harga Satuan Avtur (per L)	Jumlah Harga
1	DC-9-15	32.594	1,7725	Rp 9630,-	Rp 177,082.51
2	DC-10-40	101.686			Rp 552,458.01
3	MD-11 Freighter	103.538			Rp 562,517.34
4	B739ER	40.763			Rp 221,464.28
5	B748	152.016			Rp 825,897.07
6	B753	53.468			Rp 290,489.61
7	B773ER	122.408			Rp 665,037.79
8	A339	92.752			Rp 503,920.47
9	A359	138.693			Rp 753,516.01
10	A388	225.668			Rp 1,226,046.10

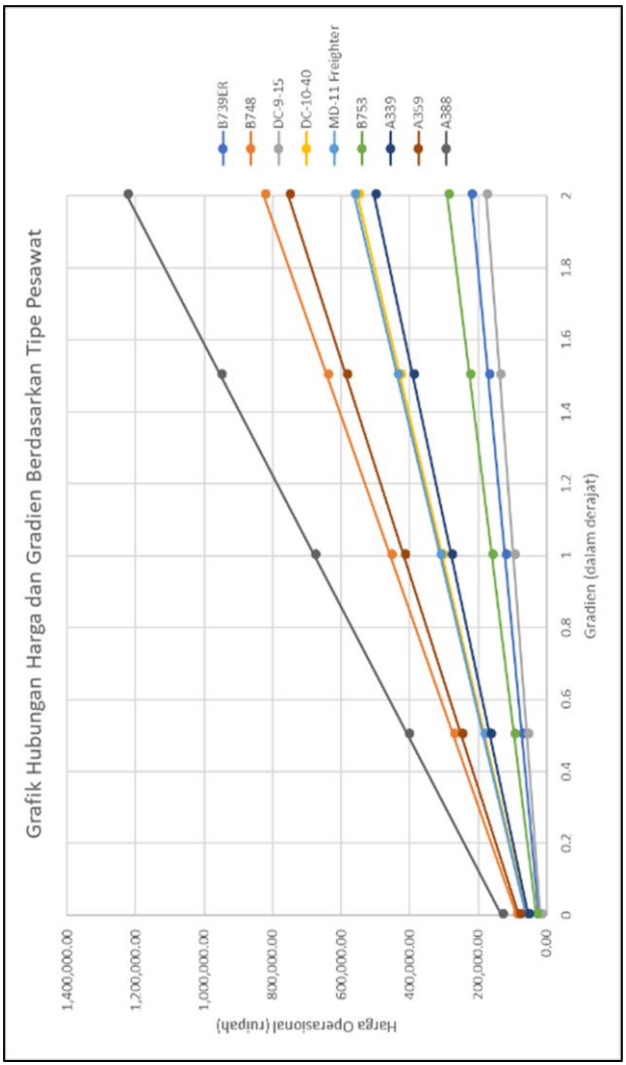
Dari hasil perhtitungan dan analisa dengan menggunakan beberapa sudut gradien, diperoleh hasil yang menyatakan bahwa biaya operasional pesawat akan semakin tinggi seiring dengan pertambahan gradien. Nilai perbandingan antara harga operasional pesawat untuk tiap gradien kemiringan yang berbeda-beda dapat dilihat pada Tabel 4.50.

Tabel 4. 50 Rekapitulasi Perhitungan Harga Konsumsi Bahan Bakar Untuk Tiap Gradien

No	Jenis Pesawat	Gradien 0°	Gradien 0,5°	Gradien 1°	Gradien 1,5°	Gradien 2°
1	DC-9-15	Rp 19,122.88	Rp 58,597.82	Rp 98,078.74	Rp 137,571.64	Rp 177,082.51
2	DC-10-40	Rp 59,659.12	Rp 182,812.14	Rp 305,983.83	Rp 429,192.89	Rp 552,458.01
3	MD-11 Freighter	Rp 60,745.41	Rp 186,140.84	Rp 311,555.28	Rp 437,007.77	Rp 562,517.34
4	B739ER	Rp 23,915.60	Rp 73,284.05	Rp 122,659.98	Rp 172,050.89	Rp 221,464.28
5	B748	Rp 89,187.39	Rp 273,295.00	Rp 457,430.52	Rp 641,621.88	Rp 825,897.07
6	B753	Rp 31,369.54	Rp 96,125.00	Rp 160,890.28	Rp 225,675.21	Rp 290,489.61
7	B773ER	Rp 71,816.44	Rp 220,065.56	Rp 368,337.16	Rp 516,653.73	Rp 665,037.79
8	A339	Rp 54,417.62	Rp 166,750.73	Rp 279,100.88	Rp 391,485.10	Rp 503,920.47
9	A359	Rp 81,371.07	Rp 249,343.61	Rp 417,341.62	Rp 585,390.58	Rp 753,516.01
10	A388	Rp 132,398.89	Rp 405,707.05	Rp 679,056.66	Rp 952,489.17	Rp 1,226,046.10

Untuk korelasi antara harga operasional dan gradien yang berbeda-beda dapat dilihat pada grafik hasil plotting antara harga dan gradien yang diperhitungkan. Hal tersebut dapat dilihat pada Gambar 4.7 yang merupakan grafik pengaruh harga operasional pesawat akibat adanya gradien pada bagian *exit taxiway*.

Dari Gambar 4.7 dapat diperoleh nilai harga operasional yang akan dikeluarkan oleh pihak maskapai jika melalui exit taxiway yang direncancakan dengan gradien tertentu. Misalnya saja dengan gradien 0,8 maka akan diperoleh harga operasinal sekitar Rp 125.000,- untuk pesawat tipe Boeing 737-900ER.



Gambar 4. 7 Grafik Hubungan Harga dan Gradien untuk Beberapa Tipe Pesawat

“Halaman ini sengaja dikosongkan”

BAB V
PENUTUP

5.1 Kesimpulan

Berdasarkan analisis dan pembahasan yang dilakukan dalam penyusunan laporan Tugas Akhir ini, maka dapat diambil kesimpulan sebagai berikut :

1. Nilai distribusi gaya berat untuk tiap roda yang paling kritis untuk perancangan kemiringan holding position adalah 32585 kg untuk tiap roda yaitu gaya berat pada pesawat Airbus 350-900.
2. Kemiringan Holding Position yang paling kritis untuk digunakan adalah 18° (g = 32,5 %) akan tetapi pada kenyataan di lapangan tidak mungkin gradien yang digunakan mencapai 18° maka untuk perancangan gradien holding position dapat mengikuti peraturan gradien memanjang *taxiway*.
3. Untuk kemiringan 2,5° (g = 4,4 %) terdapat beberapa pesawat yang belum mencapai kecepatan *taxiing* yang diisyaratkan, dan untuk kemiringan 2°, semua tipe pesawat sudah mampu mencapai batas kecepatan pesawat dalam keadaan *taxiing* yaitu 10-20 knot. Untuk itu dalam perancangan exit taxiway, gradien maximum yang dapat digunakan agar semua pesawat dapat berjalan adalah 2° atau setara dengan gradien 3,5 %.
4. Adanya perbedaan tinggi antara runway dan ujung taxiway menyebabkan pertambahan terhadap penggunaan bahan bakar untuk pesawat yang tentunya akan membuat biaya operasional bertambah. Tanpa gradien konsumsi bahan bakar membutuhkan bahan bakar untuk pesawat Boeing 737-900 ER sebesar 4,402 lbs sedangkan untuk Gradien 2° (3,5 %) penggunaan konsumsi bahan bakar mencapai angka 40,763 lbs.

5. Dalam perancangan exit taxiway, gradien sangat berpengaruh besar terhadap biaya operasional dari pesawat. Misalnya saja untuk gradien 2° (g = 3,5%) pesawat seperti Boeing 737-900ER, pertambahan biaya operasional pesawat dapat mencapai angka Rp 197.548,- untuk melewati exit taxiway. Sedangkan untuk pesawat besar seperti Boeing 747-8 pertambahan biaya operasional mencapai angka Rp 736.709,-.

5.2 Saran

Saran untuk perancangan gradien holding position dan *exit taxiway* berdasarkan Tugas Akhir ini adalah sebagai berikut :

1. Untuk perancangan holding position, kemiringan harus tidak melebihi kemiringan kritis berdasarkan hasil analisa dan perhitungan yang dilakukan.
2. Untuk beberapa pesawat gradien *Exit Taxiway* sangat berpengaruh besar, oleh karena itu sebisa mungkin adanya gradien atau perbedaan tinggi terhadap *exit taxiway* dapat diminimumkan.

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LAMPIRAN II

Perhitungan Distribusi Gaya Berat Pada 1 Roda dan Gaya Resultan Yang Bekerja Pada Holding Taxiway Bergradien

a. Kemiringan 1° (g = 1,8 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14731.885	756.312	13975.574
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14731.885	756.312	13975.574
3	ATR 72-500	22800	50265	95.00%	2	2	5415	18058.440	927.092	17131.348
4	ATR 72-600	22800	50265	95.00%	2	2	5415	18058.440	927.092	17131.348
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31899.184	1637.654	30261.530
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	35169.663	1805.555	33364.108
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37983.453	1950.011	36033.442
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37983.453	1950.011	36033.442
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	40093.989	2058.362	38035.627
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	42555.765	2184.746	40371.019
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	49237.838	2527.793	46710.045
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	114302.373	5868.104	108434.269
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	124852.729	6409.743	118442.986
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	75615.279	3881.969	71733.309
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	99695.262	5118.198	94577.065
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	99695.262	5118.198	94577.065
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	108229.460	5556.330	102673.129
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	113256.517	5814.411	107442.106
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	108229.460	5556.330	102673.129
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	108229.460	5556.330	102673.129
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	108229.460	5556.330	102673.129
22	MD-81	63504	140000	92.40%	2	2	14669.424	48920.945	2511.524	46409.420
23	MD-82	67812	149500	92.40%	2	2	15664.572	52239.656	2681.902	49557.754
24	MD-83	72575	160000	92.40%	2	2	16764.825	55908.881	2870.274	53038.607
25	MD-87	63503	140000	92.40%	2	2	14669.193	48920.174	2511.485	46408.690
26	MD-88	67812	149500	92.40%	2	2	15664.572	52239.656	2681.902	49557.754
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	28458.821	1461.031	26997.790
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	30648.332	1573.437	29074.895
29	B707-120B	117000	257340	97.30%	2	4	14230.125	47455.930	2436.313	45019.617
30	B707-320	141700	312000	96.00%	2	4	17004	56706.504	2911.223	53795.281
31	B707-420	141700	312000	96.00%	2	4	17004	56706.504	2911.223	53795.281
32	B707-320B	148500	327000	96.00%	2	4	17820	59427.775	3050.928	56376.847
33	B707-320C	151500	333600	96.00%	2	4	18180	60628.337	3112.563	57515.773
34	B717-200	54884	121000	96.00%	2	2	13172.16	43927.731	2255.181	41672.550
35	B720	104000	229300	95.00%	2	4	12350	41185.916	2114.420	39071.496
36	B720B	106200	234300	95.00%	2	4	12611.25	42057.157	2159.148	39898.009
37	B727-100	76700	169000	95.40%	2	2	18292.95	61005.013	3131.901	57873.111
38	B727-100C	76700	169000	95.40%	2	2	18292.95	61005.013	3131.901	57873.111
39	B727-200	95100	209500	93.00%	2	2	22110.75	73736.963	3785.540	69951.424
40	B737-100	50349	110000	92.30%	2	2	11618.03175	38744.881	1989.101	36755.780
41	B737-200	52390	115000	93.70%	2	2	12272.3575	40926.987	2101.127	38825.860
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	40926.987	2101.127	38825.860
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	44471.110	2283.077	42188.033
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	45391.536	2330.330	43061.206
45	B737-300	63276	139500	90.80%	2	2	14363.652	47901.228	2459.174	45442.055
46	B737-400	68039	150000	93.80%	2	2	15955.1455	53208.687	2731.650	50477.037
47	B737-500	61689	136000	92.30%	2	2	14234.73675	47471.310	2437.102	45034.207
48	B737-600	65544	144500	91.60%	2	2	15009.576	50055.315	2569.761	47485.554
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	53692.772	2756.502	50936.269
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	61661.299	3165.594	58495.705
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	61661.299	3165.594	58495.705
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	67220.278	3450.983	63769.295
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	59299.539	3044.345	56255.194
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	61660.519	3165.554	58494.965
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	62518.490	3209.601	59308.889
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	64001.908	3285.757	60716.151
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	69211.648	3553.217	65658.431
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	131425.051	6747.155	124677.895
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	128797.323	6612.252	122185.071
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	105147.769	5398.121	99749.648

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	145678.504	7478.905	138199.599
62	B747-200C	362800	800000	94.10%	2	4	42674.35	142314.349	7306.195	135008.154
63	B747-200F	356000	785000	94.00%	2	4	41830	139498.532	7161.635	132336.897
64	B747-300	340100	750000	92.50%	2	4	39324.0625	131141.502	6732.598	124408.903
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	104920.913	5386.475	99534.439
66	B747-300	377800	833000	92.50%	2	4	43683.125	145678.504	7478.905	138199.599
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	145678.504	7478.905	138199.599
68	B747-SP	315600	698000	87.80%	2	4	34637.1	115510.988	5930.152	109580.835
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	77182.345	3962.420	73219.925
70	B747-8	447696	987000	94.70%	4	4	26498.007	88367.992	4536.674	83831.318
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	86924.914	4462.588	82462.326
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	43967.550	2257.225	41710.325
73	B757-300	122470	270000	92.70%	2	4	14191.21125	47326.157	2429.650	44896.506
74	B767-200	142882	315000	92.60%	2	4	16538.5915	55154.417	2831.541	52322.876
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	67817.302	3481.634	64335.668
76	B767-300	158758	350000	92.70%	2	4	18396.08325	61348.951	3149.559	58199.392
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	71904.540	3691.466	68213.074
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	71904.540	3691.466	68213.074
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	79982.816	4106.192	75876.624
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	73911.295	3794.490	70116.805
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	73911.295	3794.490	70116.805
82	B777-300	299370	660000	92.30%	2	6	23026.5425	76791.032	3942.331	72848.702
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	88641.690	4550.725	84090.965
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	90269.507	4634.294	85635.213
85	B777-F	347815	766800	91.70%	2	6	26578.86292	88637.637	4550.517	84087.121
86	B777-9	351535	775000	94.20%	2	6	27595.4975	92028.004	4724.573	87303.431
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	92028.004	4724.573	87303.431
88	B787-8	227930	502500	91.20%	2	4	25984.02	86653.900	4448.675	82205.226
89	B787-9	254011	560000	92.30%	2	4	29306.51913	97734.076	5017.514	92716.563
90	B787-10	254011	560000	93.20%	2	4	29592.2815	98687.063	5066.439	93620.624
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	51970.123	2668.064	49302.059
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	53866.843	2765.439	51101.404
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	56901.595	2921.238	53980.356
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	62591.754	3213.362	59378.392
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	62591.754	3213.362	59378.392
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	65067.912	3340.484	61727.427
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	67236.842	3451.834	63785.008
98	A310-200	132000	291009	93.70%	2	2	30921	103118.196	5293.926	97824.270
99	A310-300	150000	330693	94.50%	2	2	35437.5	118180.235	6067.187	112113.048
100	A318-100	68000	149914	90.80%	2	2	15436	51477.393	2642.768	48834.625
101	A319-100	64000	141096	92.70%	2	2	14832	49463.118	2539.359	46923.760
102	A319-Neo	64000	141096	90.80%	2	2	14528	48449.311	2487.311	45962.000
103	A320-200	78000	171961	95.10%	2	2	18544.5	61843.905	3174.969	58668.936
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	62373.319	3202.148	59171.171
105	A321-100	89000	196211	95.00%	2	2	21137.5	70491.280	3618.911	66872.368
106	A321-200	93500	206132	95.30%	2	2	22276.375	74289.305	3813.896	70475.409
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	76827.575	3944.207	72883.368
108	A330-200	242000	535519	92.70%	2	4	28041.75	93516.208	4800.975	88715.233
109	A330-200F	233000	513677	94.70%	2	4	27581.375	91980.907	4722.155	87258.752
110	A330-300	242000	535519	93.80%	2	4	28374.5	94625.893	4857.944	89767.949
111	A330-800	242000	533519	92.80%	2	4	28072	93617.088	4806.154	88810.934
112	A330-900	242000	533519	93.90%	2	4	28404.75	94726.774	4863.123	89863.650
113	A340-200	275000	606271	93.50%	2	4	32140.625	107185.513	5502.736	101682.778
114	A340-300	276500	609578	93.80%	2	4	32419.625	108115.948	5550.503	102565.446
115	A340-500	380000	837756	93.50%	3	4	29608.33333	98740.594	5069.187	93671.407
116	A340-600	380000	837756	92.30%	3	4	29228.33333	97473.335	5004.128	92469.207
117	A350-900	280000	617295	93.10%	2	4	32585	108667.456	5578.816	103088.640
118	A350-1000	308000	679024	94.20%	2	6	24178	80631.019	4139.470	76491.549
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	75344.242	3868.055	71476.188

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	30178.188	1549.301	28628.887
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	33411.283	1715.283	31696.000
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	35027.830	1798.274	33229.556
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	34129.660	1752.163	32377.497
124	Avro RJ85	44000	97000	95.00%	2	2	10450	34849.621	1789.125	33060.497
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	36465.377	1872.075	34593.302
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13957.324	716.547	13240.777
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14819.552	760.812	14058.740
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15484.320	794.941	14689.380
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15484.320	794.941	14689.380
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	17316.422	888.998	16427.424
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	17316.422	888.998	16427.424
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4850.035	248.993	4601.042
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5388.928	276.659	5112.269
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6179.304	317.236	5862.068
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6574.492	337.524	6236.968
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7310.979	375.334	6935.645
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7724.130	396.545	7327.586
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7724.130	396.545	7327.586
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	17047.009	875.167	16171.843
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	19040.566	977.513	18063.053
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	26225.924	1346.398	24879.527
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32980.414	1693.163	31287.252
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9980.295	512.373	9467.922
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	12197.367	626.194	11571.174
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12830.997	658.723	12172.274
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	9031.844	463.681	8568.163
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12403.297	636.766	11766.531
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	11080.596	568.860	10511.735
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	10238.660	525.637	9713.024
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4490.849	230.553	4260.296
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15807.471	811.531	14995.941
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	23172.622	1189.646	21982.976
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	15048.700	772.577	14276.124
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	39839.454	2045.295	37794.159
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	16165.472	829.910	15335.562
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	26225.924	1346.398	24879.527
157	F-50	18990	41866	95.00%	2	2	4510.125	15040.780	772.170	14268.610
158	F-70	39915	87998	95.00%	2	2	9479.8125	31614.151	1623.021	29991.130
159	F-100	43090	94997	95.00%	2	2	10233.875	34128.868	1752.122	32376.746
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	11056.042	567.600	10488.443
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	14190.924	728.540	13462.385
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3844.547	197.373	3647.174
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3808.113	195.503	3612.611
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4490.849	230.553	4260.296
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4445.703	228.235	4217.467
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4982.704	255.804	4726.900
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5974.334	306.713	5667.621
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	6046.409	310.413	5735.996
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	5065.868	260.074	4805.794
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4257.198	218.558	4038.640
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3736.038	191.802	3544.236
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3105.576	159.435	2946.141
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5424.660	278.494	5146.167
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5856.320	300.654	5555.666
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5712.170	293.254	5418.916
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7185.358	368.885	6816.473
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7904.528	405.806	7498.722
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7904.528	405.806	7498.722
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8263.320	424.226	7839.095
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7257.434	372.585	6884.848
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7257.434	372.585	6884.848

b. Kemiringan 2° (g = 3,5 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14725.154	1512.393	13212.761
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14725.154	1512.393	13212.761
3	ATR 72-500	22800	50265	95.00%	2	2	5415	18050.189	1853.901	16196.287
4	ATR 72-600	22800	50265	95.00%	2	2	5415	18050.189	1853.901	16196.287
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31884.608	3274.809	28609.799
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	35153.592	3610.560	31543.032
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37966.097	3899.427	34066.669
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37966.097	3899.427	34066.669
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	40075.669	4116.098	35959.571
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	42536.319	4368.826	38167.493
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	49215.339	5054.816	44160.523
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	114250.144	11734.420	102515.723
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	124795.679	12817.533	111978.146
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	75580.727	7762.756	67817.971
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	99649.708	10234.837	89414.871
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	99649.708	10234.837	89414.871
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	108180.005	11110.968	97069.038
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	113204.766	11627.052	101577.715
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	108180.005	11110.968	97069.038
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	108180.005	11110.968	97069.038
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	108180.005	11110.968	97069.038
22	MD-81	63504	140000	92.40%	2	2	14669.424	48898.591	5022.284	43876.307
23	MD-82	67812	149500	92.40%	2	2	15664.572	52215.786	5362.987	46852.799
24	MD-83	72575	160000	92.40%	2	2	16764.825	55883.334	5739.674	50143.660
25	MD-87	63503	140000	92.40%	2	2	14669.193	48897.821	5022.205	43875.616
26	MD-88	67812	149500	92.40%	2	2	15664.572	52215.786	5362.987	46852.799
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	28445.817	2921.617	25524.200
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	30634.328	3146.395	27487.933
29	B707-120B	117000	257340	97.30%	2	4	14230.125	47434.246	4871.883	42562.362
30	B707-320	141700	312000	96.00%	2	4	17004	56680.592	5821.559	50859.034
31	B707-420	141700	312000	96.00%	2	4	17004	56680.592	5821.559	50859.034
32	B707-320B	148500	327000	96.00%	2	4	17820	59400.621	6100.928	53299.693
33	B707-320C	151500	333600	96.00%	2	4	18180	60600.633	6224.179	54376.455
34	B717-200	54884	121000	96.00%	2	2	13172.16	43907.659	4509.674	39397.985
35	B720	104000	229300	95.00%	2	4	12350	41167.097	4228.196	36938.901
36	B720B	106200	234300	95.00%	2	4	12611.25	42037.939	4317.639	37720.300
37	B727-100	76700	169000	95.40%	2	2	18292.95	60977.137	6262.849	54714.288
38	B727-100C	76700	169000	95.40%	2	2	18292.95	60977.137	6262.849	54714.288
39	B727-200	95100	209500	93.00%	2	2	22110.75	73703.270	7569.926	66133.344
40	B737-100	50349	110000	92.30%	2	2	11618.03175	38727.177	3977.597	34749.581
41	B737-200	52390	115000	93.70%	2	2	12272.3575	40908.286	4201.614	36706.672
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	40908.286	4201.614	36706.672
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	44450.789	4565.458	39885.331
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	45370.795	4659.950	40710.845
45	B737-300	63276	139500	90.80%	2	2	14363.652	47879.340	4917.598	42961.742
46	B737-400	68039	150000	93.80%	2	2	15955.1455	53184.374	5462.468	47721.906
47	B737-500	61689	136000	92.30%	2	2	14234.73675	47449.618	4873.462	42576.156
48	B737-600	65544	144500	91.60%	2	2	15009.576	50032.443	5138.739	44893.703
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	53668.237	5512.165	48156.072
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	61633.124	6330.224	55302.900
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	61633.124	6330.224	55302.900
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	67189.563	6900.915	60288.648
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	59272.443	6087.763	53184.680
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	61632.344	6330.144	55302.200
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	62489.923	6418.224	56071.699
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	63972.663	6570.514	57402.150
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	69180.023	7105.352	62074.671
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	131364.998	13492.255	117872.742
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	128738.470	13222.490	115515.981
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	105099.723	10794.598	94305.126

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	145611.938	14955.532	130656.406
62	B747-200C	362800	800000	94.10%	2	4	42674.35	142249.320	14610.164	127639.156
63	B747-200F	356000	785000	94.00%	2	4	41830	139434.790	14321.089	125113.702
64	B747-300	340100	750000	92.50%	2	4	39324.0625	131081.578	13463.146	117618.432
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	104872.971	10771.308	94101.662
66	B747-300	377800	833000	92.50%	2	4	43683.125	145611.938	14955.532	130656.406
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	145611.938	14955.532	130656.406
68	B747-SP	315600	698000	87.80%	2	4	34637.1	115458.206	11858.498	103599.708
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	77147.077	7923.633	69223.444
70	B747-8	447696	987000	94.70%	4	4	26498.007	88327.613	9071.965	79255.648
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	86885.195	8923.817	77961.378
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	43947.459	4513.762	39433.697
73	B757-300	122470	270000	92.70%	2	4	14191.21125	47304.532	4858.561	42445.971
74	B767-200	142882	315000	92.60%	2	4	16538.5915	55129.214	5662.219	49466.995
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	67786.313	6962.207	60824.107
76	B767-300	158758	350000	92.70%	2	4	18396.08325	61320.918	6298.158	55022.760
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	71871.684	7381.807	64489.877
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	71871.684	7381.807	64489.877
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	79946.269	8211.133	71735.136
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	73877.522	7587.823	66289.699
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	73877.522	7587.823	66289.699
82	B777-300	299370	660000	92.30%	2	6	23026.5425	76755.944	7883.461	68872.483
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	88601.186	9100.063	79501.122
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	90228.259	9267.177	80961.082
85	B777-F	347815	766800	91.70%	2	6	26578.86292	88597.135	9099.647	79497.488
86	B777-9	351535	775000	94.20%	2	6	27595.4975	91985.953	9447.707	82538.246
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	91985.953	9447.707	82538.246
88	B787-8	227930	502500	91.20%	2	4	25984.02	86614.305	8895.995	77718.310
89	B787-9	254011	560000	92.30%	2	4	29306.51913	97689.418	10033.499	87655.919
90	B787-10	254011	560000	93.20%	2	4	29592.2815	98641.969	10131.334	88510.635
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	51946.376	5335.316	46611.060
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	53842.229	5530.036	48312.194
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	56875.594	5841.587	51034.007
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	62563.154	6425.746	56137.408
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	62563.154	6425.746	56137.408
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	65038.180	6679.951	58358.229
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	67206.119	6902.616	60303.503
98	A310-200	132000	291009	93.70%	2	2	30921	103071.077	10586.239	92484.838
99	A310-300	150000	330693	94.50%	2	2	35437.5	118126.234	12132.526	105993.708
100	A318-100	68000	149914	90.80%	2	2	15436	51453.871	5284.732	46169.139
101	A319-100	64000	141096	92.70%	2	2	14832	49440.517	5077.944	44362.573
102	A319-Neo	64000	141096	90.80%	2	2	14528	48427.173	4973.865	43453.308
103	A320-200	78000	171961	95.10%	2	2	18544.5	61815.646	6348.970	55466.676
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	62344.818	6403.321	55941.497
105	A321-100	89000	196211	95.00%	2	2	21137.5	70459.070	7236.720	63222.349
106	A321-200	93500	206132	95.30%	2	2	22276.375	74255.359	7626.630	66628.729
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	76792.469	7887.212	68905.257
108	A330-200	242000	535519	92.70%	2	4	28041.75	93473.477	9600.487	83872.989
109	A330-200F	233000	513677	94.70%	2	4	27581.375	91938.877	9442.872	82496.006
110	A330-300	242000	535519	93.80%	2	4	28374.5	94582.655	9714.409	84868.246
111	A330-800	242000	533519	92.80%	2	4	28072	93574.311	9610.844	83963.467
112	A330-900	242000	533519	93.90%	2	4	28404.75	94683.489	9724.766	84958.724
113	A340-200	275000	606271	93.50%	2	4	32140.625	107136.536	11003.795	96132.741
114	A340-300	276500	609578	93.80%	2	4	32419.625	108066.546	11099.315	96967.231
115	A340-500	380000	837756	93.50%	3	4	29608.33333	98695.476	10136.829	88558.646
116	A340-600	380000	837756	92.30%	3	4	29228.33333	97428.796	10006.731	87422.065
117	A350-900	280000	617295	93.10%	2	4	32585	108617.802	11155.933	97461.869
118	A350-1000	308000	679024	94.20%	2	6	24178	80594.175	8277.678	72316.497
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	75309.815	7734.931	67574.883

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	30164.399	3098.129	27066.269
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	33396.016	3430.043	29965.973
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	35011.824	3596.000	31415.825
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	34114.065	3503.792	30610.272
124	Avro RJ85	44000	97000	95.00%	2	2	10450	34833.697	3577.704	31255.993
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	36448.714	3743.580	32705.134
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13950.946	1432.876	12518.070
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14812.781	1521.393	13291.387
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15477.245	1589.639	13887.606
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15477.245	1589.639	13887.606
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	17308.510	1777.725	15530.785
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	17308.510	1777.725	15530.785
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4847.819	497.911	4349.909
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5386.466	553.234	4833.232
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6176.481	634.375	5542.106
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6571.488	674.945	5896.543
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7307.638	750.554	6557.084
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7720.601	792.969	6927.632
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7720.601	792.969	6927.632
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	17039.220	1750.067	15289.153
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	19031.866	1954.728	17077.138
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	26213.941	2692.385	23521.555
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32965.344	3385.809	29579.535
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9975.734	1024.589	8951.145
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	12191.794	1252.197	10939.598
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12825.134	1317.246	11507.888
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	9027.717	927.220	8100.497
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12397.630	1273.338	11124.292
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	11075.532	1137.547	9937.985
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	10233.982	1051.113	9182.869
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4488.797	461.036	4027.761
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15800.248	1622.814	14177.434
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	23162.034	2378.930	20783.104
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	15041.824	1544.918	13496.906
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	39821.249	4089.967	35731.283
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	16158.086	1659.567	14498.519
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	26213.941	2692.385	23521.555
157	F-50	18990	41866	95.00%	2	2	4510.125	15033.907	1544.105	13489.802
158	F-70	39915	87998	95.00%	2	2	9479.8125	31599.705	3245.547	28354.158
159	F-100	43090	94997	95.00%	2	2	10233.875	34113.273	3503.711	30609.562
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	11050.990	1135.027	9915.964
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	14184.440	1456.858	12727.582
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3842.790	394.686	3448.104
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3806.373	390.946	3415.428
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4488.797	461.036	4027.761
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4443.671	456.401	3987.270
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4980.427	511.530	4468.897
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5971.604	613.332	5358.272
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	6043.646	620.732	5422.915
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	5063.553	520.068	4543.485
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4255.253	437.049	3818.204
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3734.331	383.546	3350.785
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3104.157	318.822	2785.335
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5422.182	556.902	4865.279
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5853.644	601.217	5252.428
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5709.560	586.418	5123.141
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7182.075	737.658	6444.417
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7900.916	811.488	7089.427
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7900.916	811.488	7089.427
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8259.545	848.323	7411.222
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7254.117	745.057	6509.061
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7254.117	745.057	6509.061

c. Kemiringan 3°(g = 5 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14713.93689	2268.013991	12445.92
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14713.93689	2268.013991	12445.92
3	ATR 72-500	22800	50265	95.00%	2	2	5415	18036.43877	2780.146182	15256.29
4	ATR 72-600	22800	50265	95.00%	2	2	5415	18036.43877	2780.146182	15256.29
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31860.31987	4910.966505	26949.35
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	35126.81386	5414.46561	29712.35
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37937.1758	5847.656283	32089.52
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37937.1758	5847.656283	32089.52
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	40045.14087	6172.579129	33872.56
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	42503.91716	6551.576204	35952.34
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	49177.84917	7580.299602	41597.55
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	114163.1131	17597.16245	96565.95
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	124700.6151	19221.41857	105479.2
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	75523.15316	11641.17865	63881.97
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	99573.79914	15348.3579	84225.44
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	99573.79914	15348.3579	84225.44
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	108097.5986	16662.22085	91435.38
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	113118.5318	17436.15014	95682.38
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	108097.5986	16662.22085	91435.38
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	108097.5986	16662.22085	91435.38
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	108097.5986	16662.22085	91435.38
22	MD-81	63504	140000	92.40%	2	2	14669.424	48861.34214	7531.513043	41329.83
23	MD-82	67812	149500	92.40%	2	2	15664.572	52176.00991	8042.43768	44133.57
24	MD-83	72575	160000	92.40%	2	2	16764.825	55840.76446	8607.324878	47233.44
25	MD-87	63503	140000	92.40%	2	2	14669.193	48860.57272	7531.394444	41329.18
26	MD-88	67812	149500	92.40%	2	2	15664.572	52176.00991	8042.43768	44133.57
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	28424.14846	4381.313231	24042.84
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	30610.99221	4718.394481	25892.6
29	B707-120B	117000	257340	97.30%	2	4	14230.125	47398.11232	7305.970025	40092.14
30	B707-320	141700	312000	96.00%	2	4	17004	56637.41547	8730.121086	47907.29
31	B707-420	141700	312000	96.00%	2	4	17004	56637.41547	8730.121086	47907.29
32	B707-320B	148500	327000	96.00%	2	4	17820	59355.37189	9149.068322	50206.3
33	B707-320C	151500	333600	96.00%	2	4	18180	60554.47032	9333.897985	51220.57
34	B717-200	54884	121000	96.00%	2	2	13172.16	43874.21186	6762.794152	37111.42
35	B720	104000	229300	95.00%	2	4	12350	41135.73754	6340.684275	34795.05
36	B720B	106200	234300	95.00%	2	4	12611.25	42005.9166	6474.814134	35531.1
37	B727-100	76700	169000	95.40%	2	2	18292.95	60930.68744	9391.888292	51538.8
38	B727-100C	76700	169000	95.40%	2	2	18292.95	60930.68744	9391.888292	51538.8
39	B727-200	95100	209500	93.00%	2	2	22110.75	73647.12621	11352.00687	62295.12
40	B737-100	50349	110000	92.30%	2	2	11618.03175	38697.6765	5964.880261	32732.8
41	B737-200	52390	115000	93.70%	2	2	12272.3575	40877.12365	6300.821394	34576.3
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	40877.12365	6300.821394	34576.3
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	44416.92881	6846.448827	37570.48
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	45336.23343	6988.150927	38348.08
45	B737-300	63276	139500	90.80%	2	2	14363.652	47842.86791	7374.524888	40468.34
46	B737-400	68039	150000	93.80%	2	2	15955.1455	53143.86054	8191.622686	44952.24
47	B737-500	61689	136000	92.30%	2	2	14234.73675	47413.47327	7308.33777	40105.14
48	B737-600	65544	144500	91.60%	2	2	15009.576	49994.33027	7706.15243	42288.18
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	53627.35534	8266.14883	45361.21
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	61586.1746	9492.925427	52093.25
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	61586.1746	9492.925427	52093.25
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	67138.38084	10348.74542	56789.64
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	59227.29153	9129.325947	50097.97
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	61585.39518	9492.805288	52092.59
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	62442.32088	9624.892266	52817.43
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	63923.93188	9853.268568	54070.66
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	69127.32456	10655.32226	58472
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	131264.9295	20233.24546	111031.7
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	128640.4029	19828.69953	108811.7
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	105019.6628	16187.78621	88831.88

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	145501.0174	22427.60354	123073.4
62	B747-200C	362800	800000	94.10%	2	4	42674.35	142140.9604	21909.68259	120231.3
63	B747-200F	356000	785000	94.00%	2	4	41830	139328.575	21476.18002	117852.4
64	B747-300	340100	750000	92.50%	2	4	39324.0625	130981.7258	20189.59228	110792.1
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	104793.0832	16152.8611	88640.22
66	B747-300	377800	833000	92.50%	2	4	43683.125	145501.0174	22427.60354	123073.4
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	145501.0174	22427.60354	123073.4
68	B747-SP	315600	698000	87.80%	2	4	34637.1	115370.2554	17783.23201	97587.02
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	77088.3101	11882.43277	65205.88
70	B747-8	447696	987000	94.70%	4	4	26498.007	88260.32884	13604.49363	74655.84
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	86819.00983	13382.32795	73436.68
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	43913.98196	6768.924336	37145.06
73	B757-300	122470	270000	92.70%	2	4	14191.21125	47268.49727	7285.991094	39982.51
74	B767-200	142882	315000	92.60%	2	4	16538.5915	55087.21936	8491.17304	46596.05
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	67734.67666	10440.65878	57294.02
76	B767-300	158758	350000	92.70%	2	4	18396.08325	61274.20666	9444.838525	51829.37
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	71816.93563	11069.90033	60747.04
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	71816.93563	11069.90033	60747.04
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	79885.36914	12313.57292	67571.8
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	73821.24529	11378.84568	62442.4
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	73821.24529	11378.84568	62442.4
82	B777-300	299370	660000	92.30%	2	6	23026.5425	76697.47438	11822.18914	64875.29
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	88533.6933	13646.63017	74887.06
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	90159.52754	13897.23712	76262.29
85	B777-F	347815	766800	91.70%	2	6	26578.86292	88529.64607	13646.00633	74883.64
86	B777-9	351535	775000	94.20%	2	6	27595.4975	91915.88197	14167.96251	77747.92
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	91915.88197	14167.96251	77747.92
88	B787-8	227930	502500	91.20%	2	4	25984.02	86548.32606	13340.60462	73207.72
89	B787-9	254011	560000	92.30%	2	4	29306.51913	97615.00233	15046.42793	82568.57
90	B787-10	254011	560000	93.20%	2	4	29592.2815	98566.82792	15193.14283	83373.69
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	51906.80565	8000.942394	43905.86
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	53801.21462	8292.947591	45508.27
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	56832.26896	8760.155906	48072.11
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	62515.49586	9636.171496	52879.32
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	62515.49586	9636.171496	52879.32
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	64988.63635	10017.38268	54971.25
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	67154.92423	10351.29543	56803.63
98	A310-200	132000	291009	93.70%	2	2	30921	102992.562	15875.32781	87117.23
99	A310-300	150000	330693	94.50%	2	2	35437.5	118036.2509	18194.16996	99842.08
100	A318-100	68000	149914	90.80%	2	2	15436	51414.67568	7925.08522	43489.59
101	A319-100	64000	141096	92.70%	2	2	14832	49402.85499	7614.982118	41787.87
102	A319-Neo	64000	141096	90.80%	2	2	14528	48390.28299	7458.903736	40931.38
103	A320-200	78000	171961	95.10%	2	2	18544.5	61768.55747	9521.038019	52247.52
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	62297.32656	9602.542766	52694.78
105	A321-100	89000	196211	95.00%	2	2	21137.5	70405.39694	10852.32501	59553.07
106	A321-200	93500	206132	95.30%	2	2	22276.375	74198.79476	11437.04135	62761.75
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	76733.97194	11827.8149	64906.16
108	A330-200	242000	535519	92.70%	2	4	28041.75	93402.27271	14397.07557	79005.2
109	A330-200F	233000	513677	94.70%	2	4	27581.375	91868.84234	14160.7118	77708.13
110	A330-300	242000	535519	93.80%	2	4	28374.5	94510.60605	14567.91465	79942.69
111	A330-800	242000	533519	92.80%	2	4	28072	93503.03029	14412.60639	79090.42
112	A330-900	242000	533519	93.90%	2	4	28404.75	94611.36362	14583.44548	80027.92
113	A340-200	275000	606271	93.50%	2	4	32140.625	107054.9242	16501.50247	90553.42
114	A340-300	276500	609578	93.80%	2	4	32419.625	107984.2255	16644.74546	91339.48
115	A340-500	380000	837756	93.50%	3	4	29608.33333	98620.29383	15201.38409	83418.91
116	A340-600	380000	837756	92.30%	3	4	29228.33333	97354.57883	15006.28612	82348.29
117	A350-900	280000	617295	93.10%	2	4	32585	108535.0613	16729.65159	91805.41
118	A350-1000	308000	679024	94.20%	2	6	24178	80532.78236	12413.36554	68119.42
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	75252.44698	11599.45186	63653

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	30141.42061	4646.014466	25495.41
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	33370.576	5143.758182	28226.82
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	34985.1537	5392.630039	29592.52
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	34088.07819	5254.354348	28833.72
124	Avro RJ85	44000	97000	95.00%	2	2	10450	34807.16253	5365.194386	29441.97
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	36420.94916	5613.944308	30807
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13940.31897	2148.768117	11791.55
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14801.49697	2281.510548	12519.99
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15465.45517	2383.853415	13081.6
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15465.45517	2383.853415	13081.6
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	17295.32495	2665.910508	14629.41
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	17295.32495	2665.910508	14629.41
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4844.126282	746.6761795	4097.45
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5382.362536	829.6401994	4552.722
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6171.775708	951.320762	5220.455
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6566.482294	1012.161043	5554.321
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7302.071841	1125.545204	6176.527
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7714.719635	1189.150953	6525.569
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7714.719635	1189.150953	6525.569
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	17026.23998	2624.433609	14401.81
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	19017.36789	2931.347115	16086.02
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	26193.97195	4037.552648	22156.42
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32940.2329	5077.424869	27862.81
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9968.135417	1536.493649	8431.642
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	12182.50689	1877.818035	10304.69
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12815.36439	1975.367024	10840
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	9020.83961	1390.476974	7630.363
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12388.18557	1909.521457	10478.66
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	11067.09554	1705.887942	9361.208
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	10226.18614	1576.269723	8649.916
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4485.377535	691.3784584	3793.999
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15788.21249	2433.603399	13354.61
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	23144.38987	3567.488458	19576.9
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	15030.36564	2316.788485	12713.58
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	39790.91535	6133.392673	33657.52
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	16145.77698	2488.718578	13657.06
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	26193.97195	4037.552648	22156.42
157	F-50	18990	41866	95.00%	2	2	4510.125	15022.45492	2315.569123	12706.89
158	F-70	39915	87998	95.00%	2	2	9479.8125	31575.63392	4867.084862	26708.55
159	F-100	43090	94997	95.00%	2	2	10233.875	34087.28712	5254.232411	28833.05
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	11042.57231	1702.107919	9340.464
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	14173.6348	2184.731541	11988.9
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3839.862885	591.8784898	3247.984
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3803.473578	586.2694229	3217.204
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4485.377535	691.3784584	3793.999
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4440.286438	684.428093	3755.858
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4976.63317	767.100861	4209.532
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5967.055158	919.7650285	5047.29
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	6039.042699	930.861226	5108.181
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	5059.695717	779.9041658	4279.792
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4252.011332	655.4072688	3596.604
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3731.486038	575.1732255	3156.313
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3101.792825	478.1119816	2623.681
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5418.051277	835.1412807	4582.91
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5849.185449	901.5965294	4947.589
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5705.210367	879.4041344	4825.806
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7176.604056	1106.205533	6070.399
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7894.897319	1216.923636	6677.974
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7894.897319	1216.923636	6677.974
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8253.252879	1272.160751	6981.092
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7248.591597	1117.301731	6131.29
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7248.591597	1117.301731	6131.29

d. Kemiringan 4° (g = 7 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14698.238	3022.944	11675.294
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14698.238	3022.944	11675.294
3	ATR 72-500	22800	50265	95.00%	2	2	5415	18017.195	3705.544	14311.651
4	ATR 72-600	22800	50265	95.00%	2	2	5415	18017.195	3705.544	14311.651
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31826.327	6545.628	25280.699
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	35089.335	7216.722	27872.614
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37896.699	7794.104	30102.595
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37896.699	7794.104	30102.595
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	40002.415	8227.180	31775.234
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	42458.568	8732.330	33726.238
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	49125.379	10103.474	39021.905
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	114041.307	23454.544	90586.763
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	124567.566	25619.449	98948.117
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	75442.574	15516.055	59926.519
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	99467.559	20457.204	79010.355
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	99467.559	20457.204	79010.355
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	107982.264	22208.398	85773.866
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	112997.840	23239.937	89757.903
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	107982.264	22208.398	85773.866
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	107982.264	22208.398	85773.866
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	107982.264	22208.398	85773.866
22	MD-81	63504	140000	92.40%	2	2	14669.424	48809.210	10038.448	38770.761
23	MD-82	67812	149500	92.40%	2	2	15664.572	52120.341	10719.439	41400.902
24	MD-83	72575	160000	92.40%	2	2	16764.825	55781.185	11472.354	44308.831
25	MD-87	63503	140000	92.40%	2	2	14669.193	48808.441	10038.290	38770.151
26	MD-88	67812	149500	92.40%	2	2	15664.572	52120.341	10719.439	41400.902
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	28393.821	5839.675	22554.147
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	30578.332	6288.957	24289.375
29	B707-120B	117000	257340	97.30%	2	4	14230.125	47347.541	9737.831	37609.710
30	B707-320	141700	312000	96.00%	2	4	17004	56576.986	11636.024	44940.962
31	B707-420	141700	312000	96.00%	2	4	17004	56576.986	11636.024	44940.962
32	B707-320B	148500	327000	96.00%	2	4	17820	59292.043	12194.422	47097.621
33	B707-320C	151500	333600	96.00%	2	4	18180	60489.862	12440.774	48049.088
34	B717-200	54884	121000	96.00%	2	2	13172.16	43827.400	9013.854	34813.546
35	B720	104000	229300	95.00%	2	4	12350	41091.848	8451.241	32640.607
36	B720B	106200	234300	95.00%	2	4	12611.25	41961.099	8630.017	33331.081
37	B727-100	76700	169000	95.40%	2	2	18292.95	60865.678	12518.067	48347.611
38	B727-100C	76700	169000	95.40%	2	2	18292.95	60865.678	12518.067	48347.611
39	B727-200	95100	209500	93.00%	2	2	22110.75	73568.549	15130.630	58437.919
40	B737-100	50349	110000	92.30%	2	2	11618.03175	38656.388	7950.347	30706.041
41	B737-200	52390	115000	93.70%	2	2	12272.3575	40833.510	8398.109	32435.401
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	40833.510	8398.109	32435.401
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	44369.538	9125.354	35244.184
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	45287.862	9314.223	35973.639
45	B737-300	63276	139500	90.80%	2	2	14363.652	47791.822	9829.205	37962.617
46	B737-400	68039	150000	93.80%	2	2	15955.1455	53087.159	10918.282	42168.877
47	B737-500	61689	136000	92.30%	2	2	14234.73675	47362.886	9740.987	37621.899
48	B737-600	65544	144500	91.60%	2	2	15009.576	49940.989	10271.218	39669.771
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	53570.138	11017.615	42552.523
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	61520.465	12652.735	48867.730
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	61520.465	12652.735	48867.730
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	67066.748	13793.423	53273.325
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	59164.099	12168.108	46995.991
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	61519.687	12652.575	48867.112
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	62375.698	12828.629	49547.070
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	63855.728	13133.022	50722.706
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	69053.569	14202.047	54851.522
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	131124.877	26968.072	104156.804
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	128503.150	26428.870	102074.281
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	104907.612	21576.044	83331.569

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	145345.776	29892.843	115452.932
62	B747-200C	362800	800000	94.10%	2	4	42674.35	141989.304	29202.527	112786.776
63	B747-200F	356000	785000	94.00%	2	4	41830	139179.919	28624.729	110555.189
64	B747-300	340100	750000	92.50%	2	4	39324.0625	130841.975	26909.889	103932.086
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	104681.275	21529.494	83151.781
66	B747-300	377800	833000	92.50%	2	4	43683.125	145345.776	29892.843	115452.932
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	145345.776	29892.843	115452.932
68	B747-SP	315600	698000	87.80%	2	4	34637.1	115247.162	23702.549	91544.613
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	77006.061	15837.613	61168.448
70	B747-8	447696	987000	94.70%	4	4	26498.007	88166.160	18132.878	70033.282
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	86726.379	17836.762	68889.616
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	43867.128	9022.025	34845.103
73	B757-300	122470	270000	92.70%	2	4	14191.21125	47218.064	9711.202	37506.862
74	B767-200	142882	315000	92.60%	2	4	16538.5915	55028.444	11317.540	43710.904
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	67662.407	13915.931	53746.477
76	B767-300	158758	350000	92.70%	2	4	18396.08325	61208.830	12588.642	48620.188
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	71740.311	14754.621	56985.690
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	71740.311	14754.621	56985.690
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	79800.136	16412.262	63387.874
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	73742.482	15166.402	58576.080
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	73742.482	15166.402	58576.080
82	B777-300	299370	660000	92.30%	2	6	23026.5425	76615.642	15757.316	60858.326
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	88439.233	18189.040	70250.193
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	90063.332	18523.064	71540.268
85	B777-F	347815	766800	91.70%	2	6	26578.86292	88435.190	18188.208	70246.981
86	B777-9	351535	775000	94.20%	2	6	27595.4975	91817.813	18883.903	72933.910
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	91817.813	18883.903	72933.910
88	B787-8	227930	502500	91.20%	2	4	25984.02	86455.984	17781.151	68674.833
89	B787-9	254011	560000	92.30%	2	4	29306.51913	97510.852	20054.774	77456.079
90	B787-10	254011	560000	93.20%	2	4	29592.2815	98461.662	20250.324	78211.338
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	51851.424	10664.132	41187.292
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	53743.812	11053.334	42690.478
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	56771.632	11676.057	45095.575
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	62448.795	12843.662	49605.133
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	62448.795	12843.662	49605.133
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	64919.297	13351.763	51567.534
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	67083.274	13796.822	53286.452
98	A310-200	132000	291009	93.70%	2	2	30921	102882.674	21159.581	81723.094
99	A310-300	150000	330693	94.50%	2	2	35437.5	117910.313	24250.271	93660.041
100	A318-100	68000	149914	90.80%	2	2	15436	51359.819	10563.025	40796.794
101	A319-100	64000	141096	92.70%	2	2	14832	49350.145	10149.701	39200.444
102	A319-Neo	64000	141096	90.80%	2	2	14528	48338.653	9941.670	38396.983
103	A320-200	78000	171961	95.10%	2	2	18544.5	61702.654	12690.205	49012.448
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	62230.859	12798.840	49432.019
105	A321-100	89000	196211	95.00%	2	2	21137.5	70330.278	14464.624	55865.654
106	A321-200	93500	206132	95.30%	2	2	22276.375	74119.629	15243.969	58875.660
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	76652.101	15764.815	60887.286
108	A330-200	242000	535519	92.70%	2	4	28041.75	93302.617	19189.278	74113.339
109	A330-200F	233000	513677	94.70%	2	4	27581.375	91770.823	18874.239	72896.585
110	A330-300	242000	535519	93.80%	2	4	28374.5	94409.768	19416.983	74992.786
111	A330-800	242000	533519	92.80%	2	4	28072	93403.268	19209.979	74193.289
112	A330-900	242000	533519	93.90%	2	4	28404.75	94510.418	19437.683	75072.735
113	A340-200	275000	606271	93.50%	2	4	32140.625	106940.702	21994.183	84946.519
114	A340-300	276500	609578	93.80%	2	4	32419.625	107869.012	22185.106	85683.906
115	A340-500	380000	837756	93.50%	3	4	29608.33333	98515.071	20261.308	78253.763
116	A340-600	380000	837756	92.30%	3	4	29228.33333	97250.707	20001.270	77249.436
117	A350-900	280000	617295	93.10%	2	4	32585	108419.260	22298.274	86120.986
118	A350-1000	308000	679024	94.20%	2	6	24178	80446.858	16545.272	63901.587
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	75172.157	15460.439	59711.718

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	30109.261	6192.484	23916.777
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	33334.971	6855.907	26479.065
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	34947.826	7187.618	27760.209
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	34051.708	7003.316	27048.392
124	Avro RJ85	44000	97000	95.00%	2	2	10450	34770.025	7151.050	27618.975
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	36382.090	7482.599	28899.491
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13925.445	2864.006	11061.440
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14785.705	3040.933	11744.772
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15448.954	3177.342	12271.613
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15448.954	3177.342	12271.613
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	17276.872	3553.284	13723.588
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	17276.872	3553.284	13723.588
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4838.958	995.214	3843.743
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5376.620	1105.794	4270.826
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6165.191	1267.977	4897.214
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6559.476	1349.068	5210.408
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7294.281	1500.194	5794.087
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7706.488	1584.971	6121.517
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7706.488	1584.971	6121.517
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	17008.074	3498.001	13510.073
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18997.077	3907.074	15090.004
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	26166.024	5381.490	20784.534
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32905.087	6767.494	26137.594
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9957.500	2047.930	7909.570
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	12169.509	2502.868	9666.641
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12801.691	2632.887	10168.804
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	9011.215	1853.310	7157.904
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12374.968	2545.124	9829.844
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	11055.288	2273.709	8781.579
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	10215.275	2100.946	8114.329
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4480.592	921.510	3559.082
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15771.367	3243.651	12527.716
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	23119.696	4754.961	18364.735
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	15014.329	3087.953	11926.376
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	39748.461	8174.950	31573.510
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	16128.550	3317.112	12811.438
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	26166.024	5381.490	20784.534
157	F-50	18990	41866	95.00%	2	2	4510.125	15006.427	3086.328	11920.099
158	F-70	39915	87998	95.00%	2	2	9479.8125	31541.944	6487.140	25054.804
159	F-100	43090	94997	95.00%	2	2	10233.875	34050.918	7003.153	27047.764
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	11030.790	2268.671	8762.120
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	14158.512	2911.940	11246.572
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3835.766	788.891	3046.875
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3799.415	781.415	3018.001
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4480.592	921.510	3559.082
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4435.549	912.246	3523.302
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4971.323	1022.438	3948.886
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5960.689	1225.918	4734.771
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	6032.599	1240.707	4791.892
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	5054.297	1039.503	4014.795
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4247.475	873.566	3373.909
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3727.505	766.625	2960.880
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3098.483	637.256	2461.227
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5412.271	1113.126	4299.145
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5842.945	1201.701	4641.243
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5699.123	1172.122	4527.001
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7168.947	1474.416	5694.531
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7886.474	1621.988	6264.486
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7886.474	1621.988	6264.486
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8244.447	1695.611	6548.836
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7240.858	1489.206	5751.652
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7240.858	1489.206	5751.652

e. Kemiringan 5° (g = 8,75 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14678.062	3776.953	10901.109
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14678.062	3776.953	10901.109
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17992.463	4629.813	13362.649
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17992.463	4629.813	13362.649
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31782.639	8178.296	23604.343
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	35041.168	9016.779	26024.389
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37844.678	9738.177	28106.501
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37844.678	9738.177	28106.501
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	39947.504	10279.276	29668.228
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	42400.285	10910.424	31489.861
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	49057.945	12623.571	36434.374
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	113884.763	29304.782	84579.982
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	124396.573	32009.676	92386.897
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	75339.014	19386.205	55952.809
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	99331.020	25559.818	73771.202
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	99331.020	25559.818	73771.202
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	107834.037	27747.811	80086.226
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	112842.729	29036.646	83806.083
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	107834.037	27747.811	80086.226
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	107834.037	27747.811	80086.226
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	107834.037	27747.811	80086.226
22	MD-81	63504	140000	92.40%	2	2	14669.424	48742.209	12542.326	36199.884
23	MD-82	67812	149500	92.40%	2	2	15664.572	52048.796	13393.175	38655.620
24	MD-83	72575	160000	92.40%	2	2	16764.825	55704.615	14333.889	41370.726
25	MD-87	63503	140000	92.40%	2	2	14669.193	48741.442	12542.128	36199.314
26	MD-88	67812	149500	92.40%	2	2	15664.572	52048.796	13393.175	38655.620
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	28354.845	7296.257	21058.588
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	30536.357	7857.603	22678.754
29	B707-120B	117000	257340	97.30%	2	4	14230.125	47282.547	12166.726	35115.821
30	B707-320	141700	312000	96.00%	2	4	17004	56499.323	14538.383	41960.940
31	B707-420	141700	312000	96.00%	2	4	17004	56499.323	14538.383	41960.940
32	B707-320B	148500	327000	96.00%	2	4	17820	59210.653	15236.061	43974.591
33	B707-320C	151500	333600	96.00%	2	4	18180	60406.828	15543.861	44862.967
34	B717-200	54884	121000	96.00%	2	2	13172.16	43767.239	11262.168	32505.070
35	B720	104000	229300	95.00%	2	4	12350	41035.441	10559.223	30476.218
36	B720B	106200	234300	95.00%	2	4	12611.25	41903.499	10782.591	31120.907
37	B727-100	76700	169000	95.40%	2	2	18292.95	60782.128	15640.433	45141.695
38	B727-100C	76700	169000	95.40%	2	2	18292.95	60782.128	15640.433	45141.695
39	B727-200	95100	209500	93.00%	2	2	22110.75	73467.561	18904.643	54562.918
40	B737-100	50349	110000	92.30%	2	2	11618.03175	38603.325	9933.392	28669.933
41	B737-200	52390	115000	93.70%	2	2	12272.3575	40777.458	10492.839	30284.619
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	40777.458	10492.839	30284.619
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	44308.632	11401.480	32907.153
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	45225.696	11637.458	33588.238
45	B737-300	63276	139500	90.80%	2	2	14363.652	47726.218	12280.891	35445.327
46	B737-400	68039	150000	93.80%	2	2	15955.1455	53014.286	13641.615	39372.671
47	B737-500	61689	136000	92.30%	2	2	14234.73675	47297.871	12170.669	35127.202
48	B737-600	65544	144500	91.60%	2	2	15009.576	49872.435	12833.155	37039.280
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	53496.602	13765.724	39730.878
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	61436.017	15808.691	45627.325
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	61436.017	15808.691	45627.325
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	66974.686	17233.899	49740.786
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	59082.885	15203.184	43879.701
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	61435.239	15808.491	45626.748
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	62290.075	16028.457	46261.618
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	63768.074	16408.775	47359.299
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	68958.780	17744.446	51214.334
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	130944.882	33694.685	97250.198
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	128326.755	33020.989	95305.766
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	104763.606	26957.729	77805.877

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	145146.260	37348.977	107797.283
62	B747-200C	362800	800000	94.10%	2	4	42674.35	141794.395	36486.477	105307.919
63	B747-200F	356000	785000	94.00%	2	4	41830	138988.867	35764.559	103224.308
64	B747-300	340100	750000	92.50%	2	4	39324.0625	130662.369	33621.988	97040.381
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	104537.579	26899.568	77638.011
66	B747-300	377800	833000	92.50%	2	4	43683.125	145146.260	37348.977	107797.283
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	145146.260	37348.977	107797.283
68	B747-SP	315600	698000	87.80%	2	4	34637.1	115088.962	29614.646	85474.317
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	76900.355	19787.969	57112.387
70	B747-8	447696	987000	94.70%	4	4	26498.007	88045.134	22655.739	65389.396
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	86607.330	22285.763	64321.566
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	43806.912	11272.377	32534.535
73	B757-300	122470	270000	92.70%	2	4	14191.21125	47153.248	12133.455	35019.793
74	B767-200	142882	315000	92.60%	2	4	16538.5915	54952.907	14140.460	40812.447
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	67569.527	17386.964	50182.564
76	B767-300	158758	350000	92.70%	2	4	18396.08325	61124.809	15728.611	45396.198
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	71641.833	18434.848	53206.985
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	71641.833	18434.848	53206.985
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	79690.594	20505.952	59184.643
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	73641.256	18949.338	54691.918
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	73641.256	18949.338	54691.918
82	B777-300	299370	660000	92.30%	2	6	23026.5425	76510.472	19687.644	56822.828
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	88317.832	22725.909	65591.923
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	89939.703	23143.248	66796.454
85	B777-F	347815	766800	91.70%	2	6	26578.86292	88313.795	22724.870	65588.925
86	B777-9	351535	775000	94.20%	2	6	27595.4975	91691.775	23594.091	68097.684
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	91691.775	23594.091	68097.684
88	B787-8	227930	502500	91.20%	2	4	25984.02	86337.306	22216.281	64121.025
89	B787-9	254011	560000	92.30%	2	4	29306.51913	97377.000	25057.010	72319.989
90	B787-10	254011	560000	93.20%	2	4	29592.2815	98326.504	25301.337	73025.168
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	51780.248	13324.073	38456.175
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	53670.038	13810.353	39859.685
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	56693.702	14588.401	42105.301
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	62363.072	16047.241	46315.831
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	62363.072	16047.241	46315.831
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	64830.182	16682.077	48148.106
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	66991.189	17238.146	49753.043
98	A310-200	132000	291009	93.70%	2	2	30921	102741.448	26437.388	76304.060
99	A310-300	150000	330693	94.50%	2	2	35437.5	117748.458	30298.986	87449.472
100	A318-100	68000	149914	90.80%	2	2	15436	51289.318	13197.747	38091.571
101	A319-100	64000	141096	92.70%	2	2	14832	49282.402	12681.328	36601.074
102	A319-Neo	64000	141096	90.80%	2	2	14528	48272.299	12421.409	35850.890
103	A320-200	78000	171961	95.10%	2	2	18544.5	61617.955	15855.507	45762.447
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	62145.435	15991.238	46154.196
105	A321-100	89000	196211	95.00%	2	2	21137.5	70233.736	18072.517	52161.219
106	A321-200	93500	206132	95.30%	2	2	22276.375	74017.885	19046.252	54971.632
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	76546.881	19697.013	56849.868
108	A330-200	242000	535519	92.70%	2	4	28041.75	93174.541	23975.636	69198.906
109	A330-200F	233000	513677	94.70%	2	4	27581.375	91644.850	23582.016	68062.834
110	A330-300	242000	535519	93.80%	2	4	28374.5	94280.172	24260.136	70020.036
111	A330-800	242000	533519	92.80%	2	4	28072	93275.053	24001.499	69273.554
112	A330-900	242000	533519	93.90%	2	4	28404.75	94380.684	24286.000	70094.684
113	A340-200	275000	606271	93.50%	2	4	32140.625	106793.905	27480.165	79313.740
114	A340-300	276500	609578	93.80%	2	4	32419.625	107720.941	27718.709	80002.232
115	A340-500	380000	837756	93.50%	3	4	29608.33333	98379.840	25315.061	73064.779
116	A340-600	380000	837756	92.30%	3	4	29228.33333	97117.211	24990.162	72127.049
117	A350-900	280000	617295	93.10%	2	4	32585	108270.434	27860.104	80410.329
118	A350-1000	308000	679024	94.20%	2	6	24178	80336.429	20672.138	59664.291
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	75068.968	19316.717	55752.251

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	30067.930	7737.068	22330.863
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	33289.213	8565.967	24723.246
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	34899.854	8980.416	25919.437
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	34004.965	8750.144	25254.821
124	Avro RJ85	44000	97000	95.00%	2	2	10450	34722.296	8934.727	25787.569
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	36332.148	9348.974	26983.175
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13906.330	3578.371	10327.959
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14765.408	3799.429	10965.979
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15427.748	3969.862	11457.886
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15427.748	3969.862	11457.886
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	17253.156	4439.575	12813.581
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	17253.156	4439.575	12813.581
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4832.315	1243.449	3588.866
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5369.239	1381.611	3987.629
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6156.728	1584.247	4572.481
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6550.472	1685.565	4864.907
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7284.268	1874.385	5409.883
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7695.910	1980.308	5715.601
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7695.910	1980.308	5715.601
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16984.727	4370.503	12614.224
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18971.000	4881.610	14089.390
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	26130.106	6723.788	19406.318
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32859.919	8455.501	24404.418
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9943.831	2558.743	7385.089
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	12152.804	3127.155	9025.649
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12784.118	3289.604	9494.514
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8998.845	2315.579	6683.266
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12357.981	3179.951	9178.030
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	11040.112	2840.837	8199.275
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	10201.253	2624.982	7576.271
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4474.441	1151.361	3323.080
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15749.718	4052.711	11697.007
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	23087.960	5940.985	17146.975
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14993.719	3858.178	11135.541
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	39693.898	10214.018	29479.880
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	16106.411	4144.495	11961.916
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	26130.106	6723.788	19406.318
157	F-50	18990	41866	95.00%	2	2	4510.125	14985.827	3856.147	11129.680
158	F-70	39915	87998	95.00%	2	2	9479.8125	31498.647	8105.219	23393.428
159	F-100	43090	94997	95.00%	2	2	10233.875	34004.176	8749.941	25254.235
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	11015.649	2834.542	8181.106
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	14139.077	3638.262	10500.815
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3830.501	985.663	2844.838
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3794.200	976.322	2817.878
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4474.441	1151.361	3323.080
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4429.460	1139.787	3289.673
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4964.499	1277.463	3687.036
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5952.506	1531.697	4420.810
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	6024.318	1550.175	4474.143
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	5047.359	1298.784	3748.575
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4241.644	1091.458	3150.186
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3722.388	957.843	2764.545
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3094.230	796.206	2298.024
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5404.841	1390.772	4014.070
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5834.924	1501.440	4333.484
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5691.300	1464.483	4226.817
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7159.106	1842.178	5316.928
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7875.648	2026.559	5849.090
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7875.648	2026.559	5849.090
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8233.130	2118.546	6114.584
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7230.918	1860.657	5370.261
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7230.918	1860.657	5370.261

f. Kemiringan 6° (g = 10,5 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14653.414	4529.812	10123.603
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14653.414	4529.812	10123.603
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17962.250	5552.672	12409.578
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17962.250	5552.672	12409.578
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31729.270	9808.472	21920.797
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	34982.328	10814.091	24168.237
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37781.130	11679.285	26101.845
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37781.130	11679.285	26101.845
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	39880.424	12328.240	27552.184
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	42329.087	13085.195	29243.892
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	48975.567	15139.822	33835.745
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	113693.529	35146.092	78547.436
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	124187.687	38390.153	85797.534
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	75212.506	23250.450	51962.056
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	99164.225	30654.647	68509.578
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	99164.225	30654.647	68509.578
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	107652.963	33278.772	74374.192
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	112653.244	34824.509	77828.735
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	107652.963	33278.772	74374.192
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	107652.963	33278.772	74374.192
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	107652.963	33278.772	74374.192
22	MD-81	63504	140000	92.40%	2	2	14669.424	48660.362	15042.383	33617.979
23	MD-82	67812	149500	92.40%	2	2	15664.572	51961.396	16062.832	35898.564
24	MD-83	72575	160000	92.40%	2	2	16764.825	55611.076	17191.058	38420.018
25	MD-87	63503	140000	92.40%	2	2	14669.193	48659.596	15042.146	33617.450
26	MD-88	67812	149500	92.40%	2	2	15664.572	51961.396	16062.832	35898.564
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	28307.232	8750.618	19556.614
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	30485.081	9423.856	21061.225
29	B707-120B	117000	257340	97.30%	2	4	14230.125	47203.151	14591.915	32611.236
30	B707-320	141700	312000	96.00%	2	4	17004	56404.450	17436.314	38968.137
31	B707-420	141700	312000	96.00%	2	4	17004	56404.450	17436.314	38968.137
32	B707-320B	148500	327000	96.00%	2	4	17820	59111.227	18273.060	40838.167
33	B707-320C	151500	333600	96.00%	2	4	18180	60305.393	18642.212	41663.181
34	B717-200	54884	121000	96.00%	2	2	13172.16	43693.745	13507.052	30186.693
35	B720	104000	229300	95.00%	2	4	12350	40966.535	12663.989	28302.546
36	B720B	106200	234300	95.00%	2	4	12611.25	41833.135	12931.881	28901.253
37	B727-100	76700	169000	95.40%	2	2	18292.95	60680.063	18758.034	41922.029
38	B727-100C	76700	169000	95.40%	2	2	18292.95	60680.063	18758.034	41922.029
39	B727-200	95100	209500	93.00%	2	2	22110.75	73344.195	22672.899	50671.297
40	B737-100	50349	110000	92.30%	2	2	11618.03175	38538.502	11913.411	26625.091
41	B737-200	52390	115000	93.70%	2	2	12272.3575	40708.985	12584.373	28124.612
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	40708.985	12584.373	28124.612
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	44234.230	13674.132	30560.098
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	45149.753	13957.148	31192.605
45	B737-300	63276	139500	90.80%	2	2	14363.652	47646.077	14728.837	32917.240
46	B737-400	68039	150000	93.80%	2	2	15955.1455	52925.265	16360.793	36564.472
47	B737-500	61689	136000	92.30%	2	2	14234.73675	47218.449	14596.644	32621.805
48	B737-600	65544	144500	91.60%	2	2	15009.576	49788.690	15391.183	34397.507
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	53406.771	16509.641	36897.130
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	61332.854	18959.831	42373.022
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	61332.854	18959.831	42373.022
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	66862.222	20669.126	46193.096
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	58983.673	18233.629	40750.044
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	61332.077	18959.591	42372.486
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	62185.478	19223.403	42962.075
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	63660.995	19679.530	43981.465
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	68842.985	21281.439	47561.546
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	130725.001	40411.033	90313.968
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	128111.269	39603.050	88508.219
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	104587.688	32331.203	72256.485

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	144902.531	44793.735	100108.797
62	B747-200C	362800	800000	94.10%	2	4	42674.35	141556.295	43759.312	97796.983
63	B747-200F	356000	785000	94.00%	2	4	41830	138755.478	42893.495	95861.983
64	B747-300	340100	750000	92.50%	2	4	39324.0625	130442.962	40323.846	90119.115
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	104362.040	32261.448	72100.592
66	B747-300	377800	833000	92.50%	2	4	43683.125	144902.531	44793.735	100108.797
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	144902.531	44793.735	100108.797
68	B747-SP	315600	698000	87.80%	2	4	34637.1	114895.706	35517.721	79377.984
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	76771.225	23732.297	53038.928
70	B747-8	447696	987000	94.70%	4	4	26498.007	87897.290	27171.698	60725.591
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	86461.899	26727.976	59733.923
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	43733.352	13519.296	30214.056
73	B757-300	122470	270000	92.70%	2	4	14191.21125	47074.069	14552.012	32522.057
74	B767-200	142882	315000	92.60%	2	4	16538.5915	54860.630	16959.072	37901.558
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	67456.065	20852.700	46603.365
76	B767-300	158758	350000	92.70%	2	4	18396.08325	61022.169	18863.789	42158.380
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	71521.533	22109.459	49412.074
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	71521.533	22109.459	49412.074
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	79556.779	24593.395	54963.383
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	73517.598	22726.503	50791.095
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	73517.598	22726.503	50791.095
82	B777-300	299370	660000	92.30%	2	6	23026.5425	76381.996	23611.974	52770.022
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	88169.530	27255.856	60913.674
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	89788.676	27756.383	62032.294
85	B777-F	347815	766800	91.70%	2	6	26578.86292	88165.499	27254.610	60910.889
86	B777-9	351535	775000	94.20%	2	6	27595.4975	91537.807	28297.092	63240.715
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	91537.807	28297.092	63240.715
88	B787-8	227930	502500	91.20%	2	4	25984.02	86192.329	26644.644	59547.685
89	B787-9	254011	560000	92.30%	2	4	29306.51913	97213.485	30051.615	67161.870
90	B787-10	254011	560000	93.20%	2	4	29592.2815	98161.395	30344.642	67816.753
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	51693.299	15979.955	35713.344
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	53579.915	16563.165	37016.751
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	56598.502	17496.301	39102.201
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	62258.352	19245.931	43012.421
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	62258.352	19245.931	43012.421
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	64721.320	20007.308	44714.012
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	66878.697	20674.219	46204.479
98	A310-200	132000	291009	93.70%	2	2	30921	102568.925	31707.142	70861.783
99	A310-300	150000	330693	94.50%	2	2	35437.5	117550.735	36338.471	81212.264
100	A318-100	68000	149914	90.80%	2	2	15436	51203.193	15828.448	35374.745
101	A319-100	64000	141096	92.70%	2	2	14832	49199.647	15209.092	33990.555
102	A319-Neo	64000	141096	90.80%	2	2	14528	48191.240	14897.363	33293.877
103	A320-200	78000	171961	95.10%	2	2	18544.5	61514.486	19015.980	42498.507
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	62041.080	19178.766	42862.315
105	A321-100	89000	196211	95.00%	2	2	21137.5	70115.800	21674.905	48440.896
106	A321-200	93500	206132	95.30%	2	2	22276.375	73893.595	22842.735	51050.860
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	76418.344	23623.211	52795.133
108	A330-200	242000	535519	92.70%	2	4	28041.75	93018.083	28754.690	64263.394
109	A330-200F	233000	513677	94.70%	2	4	27581.375	91490.960	28282.610	63208.350
110	A330-300	242000	535519	93.80%	2	4	28374.5	94121.858	29095.900	65025.958
111	A330-800	242000	533519	92.80%	2	4	28072	93118.426	28785.709	64332.718
112	A330-900	242000	533519	93.90%	2	4	28404.75	94222.201	29126.919	65095.282
113	A340-200	275000	606271	93.50%	2	4	32140.625	106614.578	32957.775	73656.802
114	A340-300	276500	609578	93.80%	2	4	32419.625	107540.057	33243.869	74296.188
115	A340-500	380000	837756	93.50%	3	4	29608.33333	98214.641	30361.102	67853.539
116	A340-600	380000	837756	92.30%	3	4	29228.33333	96954.133	29971.441	66982.691
117	A350-900	280000	617295	93.10%	2	4	32585	108088.627	33413.448	74675.178
118	A350-1000	308000	679024	94.20%	2	6	24178	80201.529	24792.707	55408.822
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	74942.913	23167.110	51775.802

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	30017.441	9279.295	20738.146
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	33233.314	10273.418	22959.896
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	34841.250	10770.479	24070.771
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	33947.865	10494.307	23453.558
124	Avro RJ85	44000	97000	95.00%	2	2	10450	34663.991	10715.683	23948.308
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	36271.140	11212.501	25058.639
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13882.979	4291.647	9591.332
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14740.614	4556.768	10183.847
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15401.841	4761.173	10640.669
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15401.841	4761.173	10640.669
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	17224.184	5324.514	11899.671
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	17224.184	5324.514	11899.671
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4824.201	1491.306	3332.895
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5360.223	1657.006	3703.217
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6146.389	1900.034	4246.355
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6539.473	2021.548	4517.925
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7272.036	2248.005	5024.031
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7682.987	2375.043	5307.944
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7682.987	2375.043	5307.944
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16956.206	5241.674	11714.533
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18939.144	5854.660	13084.485
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	26086.229	8064.039	18022.190
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32804.741	10140.933	22663.808
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9927.134	3068.776	6858.358
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	12132.397	3750.489	8381.908
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12762.651	3945.320	8817.332
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8983.734	2777.143	6206.592
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12337.230	3813.809	8523.420
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	11021.574	3407.100	7614.473
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	10184.123	3148.219	7035.904
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4466.928	1380.862	3086.066
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15723.271	4860.536	10862.735
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	23049.191	7125.199	15923.992
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14968.542	4627.227	10341.315
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	39627.244	12249.974	27377.270
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	16079.365	4970.616	11108.749
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	26086.229	8064.039	18022.190
157	F-50	18990	41866	95.00%	2	2	4510.125	14960.663	4624.791	10335.872
158	F-70	39915	87998	95.00%	2	2	9479.8125	31445.755	9720.829	21724.925
159	F-100	43090	94997	95.00%	2	2	10233.875	33947.077	10494.063	23453.013
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10997.151	3399.550	7597.601
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	14115.335	4363.475	9751.860
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3824.068	1182.135	2641.934
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3787.829	1170.932	2616.897
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4466.928	1380.862	3086.066
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4422.022	1366.980	3055.042
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4956.163	1532.099	3424.064
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5942.511	1837.009	4105.502
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	6014.202	1859.171	4155.031
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	5038.884	1557.671	3481.213
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4234.522	1309.018	2925.504
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3716.137	1148.770	2567.367
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3089.034	954.913	2134.121
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5395.765	1667.993	3727.772
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5825.126	1800.722	4024.404
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5681.743	1756.398	3925.345
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7147.085	2209.379	4937.706
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7862.423	2430.512	5431.912
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7862.423	2430.512	5431.912
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8219.305	2540.835	5678.470
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7218.776	2231.541	4987.235
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7218.776	2231.541	4987.235

g. Kemiringan 7° (g = 12 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14624.304	5281.290	9343.013
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14624.304	5281.290	9343.013
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17926.566	6473.840	11452.726
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17926.566	6473.840	11452.726
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31666.235	11435.661	20230.574
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	34912.831	12608.108	22304.723
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37706.073	13616.834	24089.239
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37706.073	13616.834	24089.239
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	39801.197	14373.448	25427.748
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	42244.995	15255.980	26989.015
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	48878.271	17651.462	31226.809
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	113467.662	40976.697	72490.965
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	123940.972	44758.935	79182.038
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	75063.086	27107.612	47955.474
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	98967.222	35740.138	63227.084
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	98967.222	35740.138	63227.084
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	107439.097	38799.595	68639.502
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	112429.444	40601.764	71827.680
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	107439.097	38799.595	68639.502
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	107439.097	38799.595	68639.502
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	107439.097	38799.595	68639.502
22	MD-81	63504	140000	92.40%	2	2	14669.424	48563.692	17537.858	31025.834
23	MD-82	67812	149500	92.40%	2	2	15664.572	51858.168	18727.595	33130.573
24	MD-83	72575	160000	92.40%	2	2	16764.825	55500.598	20042.990	35457.608
25	MD-87	63503	140000	92.40%	2	2	14669.193	48562.927	17537.581	31025.346
26	MD-88	67812	149500	92.40%	2	2	15664.572	51858.168	18727.595	33130.573
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	28250.996	10202.312	18048.684
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	30424.518	10987.239	19437.280
29	B707-120B	117000	257340	97.30%	2	4	14230.125	47109.376	17012.659	30096.717
30	B707-320	141700	312000	96.00%	2	4	17004	56292.396	20328.933	35963.463
31	B707-420	141700	312000	96.00%	2	4	17004	56292.396	20328.933	35963.463
32	B707-320B	148500	327000	96.00%	2	4	17820	58993.795	21304.492	37689.303
33	B707-320C	151500	333600	96.00%	2	4	18180	60185.589	21734.886	38450.703
34	B717-200	54884	121000	96.00%	2	2	13172.16	43606.942	15747.821	27859.121
35	B720	104000	229300	95.00%	2	4	12350	40885.150	14764.897	26120.252
36	B720B	106200	234300	95.00%	2	4	12611.25	41750.028	15077.232	26672.796
37	B727-100	76700	169000	95.40%	2	2	18292.95	60559.514	21869.922	38689.592
38	B727-100C	76700	169000	95.40%	2	2	18292.95	60559.514	21869.922	38689.592
39	B727-200	95100	209500	93.00%	2	2	22110.75	73198.488	26434.248	46764.240
40	B737-100	50349	110000	92.30%	2	2	11618.03175	38461.941	13889.801	24572.139
41	B737-200	52390	115000	93.70%	2	2	12272.3575	40628.111	14672.073	25956.038
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	40628.111	14672.073	25956.038
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	44146.353	15942.619	28203.734
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	45060.057	16272.586	28787.471
45	B737-300	63276	139500	90.80%	2	2	14363.652	47551.422	17172.296	30379.126
46	B737-400	68039	150000	93.80%	2	2	15955.1455	52820.122	19074.987	33745.136
47	B737-500	61689	136000	92.30%	2	2	14234.73675	47124.643	17018.172	30106.471
48	B737-600	65544	144500	91.60%	2	2	15009.576	49689.778	17944.522	31745.256
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	53300.672	19248.528	34052.144
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	61211.008	22105.196	39105.812
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	61211.008	22105.196	39105.812
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	66729.392	24098.056	42631.336
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	58866.495	21258.520	37607.975
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	61210.233	22104.917	39105.317
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	62061.939	22412.494	39649.445
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	63534.524	22944.290	40590.234
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	68706.219	24811.950	43894.269
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	130465.299	47115.072	83350.227
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	127856.760	46173.047	81683.713
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	104379.911	37694.828	66685.083

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	144614.664	52224.847	92389.817
62	B747-200C	362800	800000	94.10%	2	4	42674.35	141275.076	51018.818	90256.258
63	B747-200F	356000	785000	94.00%	2	4	41830	138479.823	50009.365	88470.457
64	B747-300	340100	750000	92.50%	2	4	39324.0625	130183.820	47013.421	83170.399
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	104154.712	37613.502	66541.210
66	B747-300	377800	833000	92.50%	2	4	43683.125	144614.664	52224.847	92389.817
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	144614.664	52224.847	92389.817
68	B747-SP	315600	698000	87.80%	2	4	34637.1	114667.451	41409.978	73257.473
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	76618.709	27669.396	48949.313
70	B747-8	447696	987000	94.70%	4	4	26498.007	87722.671	31679.381	56043.289
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	86290.132	31162.047	55128.085
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	43646.470	15762.096	27884.374
73	B757-300	122470	270000	92.70%	2	4	14191.21125	46980.550	16966.136	30014.414
74	B767-200	142882	315000	92.60%	2	4	16538.5915	54751.643	19772.519	34979.124
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	67322.055	24312.085	43009.970
76	B767-300	158758	350000	92.70%	2	4	18396.08325	60900.941	21993.221	38907.719
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	71379.446	25777.335	45602.111
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	71379.446	25777.335	45602.111
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	79398.729	28673.347	50725.382
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	73371.546	26496.744	46874.802
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	73371.546	26496.744	46874.802
82	B777-300	299370	660000	92.30%	2	6	23026.5425	76230.254	27529.113	48701.141
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	87994.370	31777.500	56216.870
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	89610.300	32361.063	57249.237
85	B777-F	347815	766800	91.70%	2	6	26578.86292	87990.347	31776.047	56214.300
86	B777-9	351535	775000	94.20%	2	6	27595.4975	91355.955	32991.473	58364.482
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	91355.955	32991.473	58364.482
88	B787-8	227930	502500	91.20%	2	4	25984.02	86021.097	31064.890	54956.207
89	B787-9	254011	560000	92.30%	2	4	29306.51913	97020.358	35037.065	61983.293
90	B787-10	254011	560000	93.20%	2	4	29592.2815	97966.385	35378.705	62587.681
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	51590.603	18630.969	32959.634
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	53473.472	19310.932	34162.540
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	56486.062	20398.872	36087.190
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	62134.668	22438.759	39695.910
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	62134.668	22438.759	39695.910
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	64592.743	23326.446	41266.297
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	66745.834	24103.994	42641.840
98	A310-200	132000	291009	93.70%	2	2	30921	102365.159	36967.239	65397.920
99	A310-300	150000	330693	94.50%	2	2	35437.5	117317.206	42366.887	74950.319
100	A318-100	68000	149914	90.80%	2	2	15436	51101.471	18454.329	32647.143
101	A319-100	64000	141096	92.70%	2	2	14832	49101.906	17732.223	31369.683
102	A319-Neo	64000	141096	90.80%	2	2	14528	48095.502	17368.780	30726.723
103	A320-200	78000	171961	95.10%	2	2	18544.5	61392.280	22170.659	39221.621
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	61917.828	22360.451	39557.377
105	A321-100	89000	196211	95.00%	2	2	21137.5	69976.506	25270.690	44705.816
106	A321-200	93500	206132	95.30%	2	2	22276.375	73746.796	26632.259	47114.537
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	76266.529	27542.213	48724.317
108	A330-200	242000	535519	92.70%	2	4	28041.75	92833.291	33524.985	59308.306
109	A330-200F	233000	513677	94.70%	2	4	27581.375	91309.202	32974.589	58334.613
110	A330-300	242000	535519	93.80%	2	4	28374.5	93934.873	33922.800	60012.072
111	A330-800	242000	533519	92.80%	2	4	28072	92933.435	33561.150	59372.285
112	A330-900	242000	533519	93.90%	2	4	28404.75	94035.017	33958.965	60076.051
113	A340-200	275000	606271	93.50%	2	4	32140.625	106402.774	38425.347	67977.428
114	A340-300	276500	609578	93.80%	2	4	32419.625	107326.415	38758.902	68567.513
115	A340-500	380000	837756	93.50%	3	4	29608.33333	98019.525	35397.895	62621.630
116	A340-600	380000	837756	92.30%	3	4	29228.33333	96761.521	34943.591	61817.930
117	A350-900	280000	617295	93.10%	2	4	32585	107873.895	38956.614	68917.281
118	A350-1000	308000	679024	94.20%	2	6	24178	80042.198	28905.724	51136.474
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	74794.029	27010.447	47783.582

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	29957.807	10818.695	19139.112
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	33167.291	11977.739	21189.552
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	34772.034	12557.261	22214.772
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	33880.423	12235.273	21645.150
124	Avro RJ85	44000	97000	95.00%	2	2	10450	34595.127	12493.375	22101.752
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	36199.083	13072.613	23126.469
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13855.398	5003.615	8851.784
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14711.330	5312.718	9398.612
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15371.244	5551.034	9820.210
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15371.244	5551.034	9820.210
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	17189.966	6207.831	10982.136
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	17189.966	6207.831	10982.136
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4814.617	1738.708	3075.909
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5349.575	1931.898	3417.677
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6134.179	2215.243	3918.936
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6526.481	2356.915	4169.566
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7257.590	2620.941	4636.649
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7667.724	2769.053	4898.670
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7667.724	2769.053	4898.670
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16922.521	6111.248	10811.273
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18901.519	6825.926	12075.594
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	26034.405	9401.832	16632.573
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32739.570	11823.276	20916.294
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9907.412	3577.874	6329.538
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	12108.294	4372.681	7735.613
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12737.297	4599.833	8137.463
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8965.887	3237.860	5728.027
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12312.720	4446.506	7866.214
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10999.678	3972.325	7027.352
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	10163.891	3670.497	6493.394
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4458.054	1609.942	2848.112
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15692.035	5666.881	10025.154
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	23003.400	8307.242	14696.158
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14938.805	5394.866	9543.938
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	39548.520	14282.199	25266.321
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	16047.421	5795.222	10252.199
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	26034.405	9401.832	16632.573
157	F-50	18990	41866	95.00%	2	2	4510.125	14930.942	5392.027	9538.915
158	F-70	39915	87998	95.00%	2	2	9479.8125	31383.284	11333.479	20049.805
159	F-100	43090	94997	95.00%	2	2	10233.875	33879.637	12234.989	21644.647
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10975.304	3963.523	7011.781
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	14087.293	5087.359	8999.934
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3816.471	1378.246	2438.225
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3780.304	1365.185	2415.119
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4458.054	1609.942	2848.112
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4413.237	1593.757	2819.480
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4946.317	1786.269	3160.048
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5930.705	2141.762	3788.944
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	6002.254	2167.601	3834.654
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	5028.873	1816.082	3212.791
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4226.109	1526.179	2699.930
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3708.755	1339.347	2369.408
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3082.898	1113.330	1969.567
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5385.046	1944.707	3440.339
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5813.554	2099.455	3714.099
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5670.456	2047.778	3622.678
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7132.886	2575.907	4556.979
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7846.804	2833.725	5013.079
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7846.804	2833.725	5013.079
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8202.976	2962.350	5240.627
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7204.435	2601.745	4602.690
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7204.435	2601.745	4602.690

h. Kemiringan 8° (g = 14 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14590.738	6031.160	8559.578
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14590.738	6031.160	8559.578
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17885.421	7393.035	10492.386
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17885.421	7393.035	10492.386
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31593.555	13059.367	18534.189
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	34832.699	14398.284	20434.415
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37619.530	15550.236	22069.294
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37619.530	15550.236	22069.294
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	39709.845	16414.279	23295.566
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	42148.034	17422.117	24725.917
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	48766.086	20157.725	28608.361
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	113207.232	46794.820	66412.412
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	123656.504	51114.083	72542.421
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	74890.802	30956.517	43934.285
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	98740.074	40814.742	57925.331
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	98740.074	40814.742	57925.331
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	107192.504	44308.600	62883.904
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	112171.397	46366.652	65804.745
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	107192.504	44308.600	62883.904
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	107192.504	44308.600	62883.904
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	107192.504	44308.600	62883.904
22	MD-81	63504	140000	92.40%	2	2	14669.424	48452.229	20027.990	28424.239
23	MD-82	67812	149500	92.40%	2	2	15664.572	51739.143	21386.654	30352.489
24	MD-83	72575	160000	92.40%	2	2	16764.825	55373.213	22888.816	32484.397
25	MD-87	63503	140000	92.40%	2	2	14669.193	48451.466	20027.675	28423.791
26	MD-88	67812	149500	92.40%	2	2	15664.572	51739.143	21386.654	30352.489
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	28186.155	11650.899	16535.256
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	30354.688	12547.274	17807.414
29	B707-120B	117000	257340	97.30%	2	4	14230.125	47001.251	19428.221	27573.030
30	B707-320	141700	312000	96.00%	2	4	17004	56163.194	23215.359	32947.835
31	B707-420	141700	312000	96.00%	2	4	17004	56163.194	23215.359	32947.835
32	B707-320B	148500	327000	96.00%	2	4	17820	58858.393	24329.434	34528.959
33	B707-320C	151500	333600	96.00%	2	4	18180	60047.451	24820.938	35226.513
34	B717-200	54884	121000	96.00%	2	2	13172.16	43506.856	17983.794	25523.062
35	B720	104000	229300	95.00%	2	4	12350	40791.310	16861.308	23930.002
36	B720B	106200	234300	95.00%	2	4	12611.25	41654.204	17217.990	24436.214
37	B727-100	76700	169000	95.40%	2	2	18292.95	60420.518	24975.147	35445.371
38	B727-100C	76700	169000	95.40%	2	2	18292.95	60420.518	24975.147	35445.371
39	B727-200	95100	209500	93.00%	2	2	22110.75	73030.483	30187.544	42842.939
40	B737-100	50349	110000	92.30%	2	2	11618.03175	38373.663	15861.961	22511.702
41	B737-200	52390	115000	93.70%	2	2	12272.3575	40534.862	16755.304	23779.558
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	40534.862	16755.304	23779.558
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	44045.028	18206.250	25838.778
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	44956.636	18583.068	26373.568
45	B737-300	63276	139500	90.80%	2	2	14363.652	47442.282	19610.523	27831.759
46	B737-400	68039	150000	93.80%	2	2	15955.1455	52698.890	21783.371	30915.520
47	B737-500	61689	136000	92.30%	2	2	14234.73675	47016.483	19434.517	27581.966
48	B737-600	65544	144500	91.60%	2	2	15009.576	49575.731	20492.396	29083.335
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	53178.337	21981.552	31196.784
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	61070.517	25243.828	35826.689
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	61070.517	25243.828	35826.689
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	66576.235	27519.646	39056.589
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	58731.385	24276.935	34454.450
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	61069.744	25243.508	35826.236
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	61919.495	25594.757	36324.738
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	63388.701	26202.061	37186.639
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	68548.526	28334.903	40213.623
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	130165.856	53804.759	76361.097
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	127563.304	52728.980	74834.324
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	104140.339	43046.971	61093.368

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	144282.746	59640.052	84642.694
62	B747-200C	362800	800000	94.10%	2	4	42674.35	140950.823	58262.783	82688.039
63	B747-200F	356000	785000	94.00%	2	4	41830	138161.985	57110.002	81051.983
64	B747-300	340100	750000	92.50%	2	4	39324.0625	129885.024	53688.675	76196.348
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	103915.657	42954.098	60961.559
66	B747-300	377800	833000	92.50%	2	4	43683.125	144282.746	59640.052	84642.694
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	144282.746	59640.052	84642.694
68	B747-SP	315600	698000	87.80%	2	4	34637.1	114404.267	47289.621	67114.646
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	76442.854	31598.066	44844.788
70	B747-8	447696	987000	94.70%	4	4	26498.007	87521.330	36177.414	51343.916
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	86092.079	35586.626	50505.454
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	43546.293	18000.095	25546.198
73	B757-300	122470	270000	92.70%	2	4	14191.21125	46872.721	19375.092	27497.629
74	B767-200	142882	315000	92.60%	2	4	16538.5915	54625.977	22579.943	32046.035
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	67167.538	27764.064	39403.474
76	B767-300	158758	350000	92.70%	2	4	18396.08325	60761.161	25115.954	35645.207
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	71215.617	29437.359	41778.257
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	71215.617	29437.359	41778.257
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	79216.494	32744.565	46471.929
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	73203.144	30258.915	42944.230
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	73203.144	30258.915	42944.230
82	B777-300	299370	660000	92.30%	2	6	23026.5425	76055.291	31437.865	44617.426
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	87792.406	36289.465	51502.941
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	89404.627	36955.885	52448.742
85	B777-F	347815	766800	91.70%	2	6	26578.86292	87788.393	36287.806	51500.587
86	B777-9	351535	775000	94.20%	2	6	27595.4975	91146.276	37675.805	53470.471
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	91146.276	37675.805	53470.471
88	B787-8	227930	502500	91.20%	2	4	25984.02	85823.662	35475.674	50347.988
89	B787-9	254011	560000	92.30%	2	4	29306.51913	96797.678	40011.842	56785.835
90	B787-10	254011	560000	93.20%	2	4	29592.2815	97741.534	40401.990	57339.543
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	51472.193	21276.309	30195.884
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	53350.740	22052.816	31297.924
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	56356.416	23295.229	33061.187
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	61992.057	25624.751	36367.306
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	61992.057	25624.751	36367.306
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	64444.490	26638.478	37806.013
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	66592.640	27526.427	39066.213
98	A310-200	132000	291009	93.70%	2	2	30921	102130.211	42216.074	59914.137
99	A310-300	150000	330693	94.50%	2	2	35437.5	117047.940	48382.398	68665.543
100	A318-100	68000	149914	90.80%	2	2	15436	50984.184	21074.587	29909.596
101	A319-100	64000	141096	92.70%	2	2	14832	48989.208	20249.953	28739.254
102	A319-Neo	64000	141096	90.80%	2	2	14528	47985.114	19834.906	28150.208
103	A320-200	78000	171961	95.10%	2	2	18544.5	61251.373	25318.586	35932.787
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	61775.715	25535.325	36240.390
105	A321-100	89000	196211	95.00%	2	2	21137.5	69815.897	28858.778	40957.119
106	A321-200	93500	206132	95.30%	2	2	22276.375	73577.533	30413.670	43163.862
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	76091.483	31452.825	44638.658
108	A330-200	242000	535519	92.70%	2	4	28041.75	92620.221	38285.068	54335.153
109	A330-200F	233000	513677	94.70%	2	4	27581.375	91099.630	37656.524	53443.106
110	A330-300	242000	535519	93.80%	2	4	28374.5	93719.274	38739.368	54979.907
111	A330-800	242000	533519	92.80%	2	4	28072	92720.135	38326.368	54393.767
112	A330-900	242000	533519	93.90%	2	4	28404.75	93819.188	38780.668	55038.521
113	A340-200	275000	606271	93.50%	2	4	32140.625	106158.560	43881.213	62277.346
114	A340-300	276500	609578	93.80%	2	4	32419.625	107080.080	44262.129	62817.951
115	A340-500	380000	837756	93.50%	3	4	29608.33333	97794.552	40423.906	57370.646
116	A340-600	380000	837756	92.30%	3	4	29228.33333	96539.435	39905.096	56634.338
117	A350-900	280000	617295	93.10%	2	4	32585	107626.304	44487.913	63138.390
118	A350-1000	308000	679024	94.20%	2	6	24178	79858.486	33009.936	46848.550
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	74622.363	30845.556	43776.806

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	29889.048	12354.799	17534.249
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	33091.166	13678.412	19412.754
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	34692.225	14340.218	20352.007
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	33802.661	13972.512	19830.149
124	Avro RJ85	44000	97000	95.00%	2	2	10450	34515.724	14267.261	20248.463
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	36115.999	14928.743	21187.256
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13823.598	5714.059	8109.539
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14677.565	6067.051	8610.514
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15335.964	6339.203	8996.760
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15335.964	6339.203	8996.760
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	17150.512	7089.257	10061.255
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	17150.512	7089.257	10061.255
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4803.567	1985.580	2817.986
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5337.296	2206.200	3131.096
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6120.100	2529.776	3590.324
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6511.502	2691.564	3819.937
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7240.932	2993.078	4247.854
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7650.125	3162.220	4487.904
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7650.125	3162.220	4487.904
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16883.680	6978.960	9904.720
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18858.137	7795.113	11063.024
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	25974.651	10736.762	15237.889
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32664.426	13502.017	19162.409
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9884.673	4085.883	5798.790
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	12080.503	4993.541	7086.962
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12708.062	5252.946	7455.116
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8945.309	3697.592	5247.717
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12284.460	5077.848	7206.612
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10974.431	4536.340	6438.091
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	10140.563	4191.656	5948.906
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4447.822	1838.531	2609.291
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15656.019	6471.500	9184.519
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	22950.603	9486.756	13463.848
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14904.517	6160.863	8743.655
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	39457.748	16310.073	23147.675
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	16010.589	6618.064	9392.526
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	25974.651	10736.762	15237.889
157	F-50	18990	41866	95.00%	2	2	4510.125	14896.673	6157.620	8739.053
158	F-70	39915	87998	95.00%	2	2	9479.8125	31311.253	12942.675	18368.578
159	F-100	43090	94997	95.00%	2	2	10233.875	33801.876	13972.188	19829.688
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10950.114	4526.289	6423.825
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	14054.960	5809.693	8245.266
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3807.712	1573.938	2233.774
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3771.627	1559.023	2212.605
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4447.822	1838.531	2609.291
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4403.108	1820.049	2583.060
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4934.964	2039.894	2895.070
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5917.093	2445.862	3471.231
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5988.478	2475.370	3513.108
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	5017.331	2073.941	2943.390
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4216.409	1742.876	2473.534
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3700.243	1529.515	2170.727
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3075.822	1271.407	1804.414
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5372.686	2220.829	3151.857
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5800.211	2397.548	3402.662
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5657.441	2338.534	3318.907
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7116.515	2941.650	4174.865
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7828.794	3236.074	4592.720
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7828.794	3236.074	4592.720
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8184.149	3382.962	4801.187
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7187.900	2971.157	4216.742
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7187.900	2971.157	4216.742

i. Kemiringan 9° (g = 15,8 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14552.728	6779.193	7773.535
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14552.728	6779.193	7773.535
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17838.828	8309.979	9528.849
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17838.828	8309.979	9528.849
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31511.252	14679.094	16832.158
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	34741.957	16184.075	18557.882
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37521.528	17478.901	20042.627
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37521.528	17478.901	20042.627
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	39606.398	18450.109	21156.289
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	42038.235	19582.948	22455.287
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	48639.046	22657.847	25981.199
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	112912.318	52598.689	60313.629
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	123334.369	57453.662	65880.707
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	74695.706	34795.993	39899.713
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	98482.848	45876.914	52605.934
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	98482.848	45876.914	52605.934
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	106913.259	49804.108	57109.151
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	111879.181	52117.416	59761.765
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	106913.259	49804.108	57109.151
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	106913.259	49804.108	57109.151
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	106913.259	49804.108	57109.151
22	MD-81	63504	140000	92.40%	2	2	14669.424	48326.007	22512.022	25813.985
23	MD-82	67812	149500	92.40%	2	2	15664.572	51604.359	24039.198	27565.160
24	MD-83	72575	160000	92.40%	2	2	16764.825	55228.961	25727.671	29501.290
25	MD-87	63503	140000	92.40%	2	2	14669.193	48325.246	22511.668	25813.578
26	MD-88	67812	149500	92.40%	2	2	15664.572	51604.359	24039.198	27565.160
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	28112.728	13095.937	15016.790
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	30275.612	14103.488	16172.124
29	B707-120B	117000	257340	97.30%	2	4	14230.125	46878.809	21837.864	25040.944
30	B707-320	141700	312000	96.00%	2	4	17004	56016.884	26094.714	29922.170
31	B707-420	141700	312000	96.00%	2	4	17004	56016.884	26094.714	29922.170
32	B707-320B	148500	327000	96.00%	2	4	17820	58705.062	27346.966	31358.096
33	B707-320C	151500	333600	96.00%	2	4	18180	59891.023	27899.430	31991.593
34	B717-200	54884	121000	96.00%	2	2	13172.16	43393.517	20214.288	23179.229
35	B720	104000	229300	95.00%	2	4	12350	40685.046	18952.583	21732.463
36	B720B	106200	234300	95.00%	2	4	12611.25	41545.691	19353.503	22192.188
37	B727-100	76700	169000	95.40%	2	2	18292.95	60263.118	28072.765	32190.353
38	B727-100C	76700	169000	95.40%	2	2	18292.95	60263.118	28072.765	32190.353
39	B727-200	95100	209500	93.00%	2	2	22110.75	72840.233	33931.646	38908.587
40	B737-100	50349	110000	92.30%	2	2	11618.03175	38273.697	17829.288	20444.408
41	B737-200	52390	115000	93.70%	2	2	12272.3575	40429.265	18833.431	21595.834
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	40429.265	18833.431	21595.834
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	43930.288	20464.335	23465.952
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	44839.520	20887.889	23951.631
45	B737-300	63276	139500	90.80%	2	2	14363.652	47318.691	22042.778	25275.914
46	B737-400	68039	150000	93.80%	2	2	15955.1455	52561.605	24485.119	28076.486
47	B737-500	61689	136000	92.30%	2	2	14234.73675	46894.001	21844.942	25049.060
48	B737-600	65544	144500	91.60%	2	2	15009.576	49446.582	23034.027	26412.555
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	53039.803	24707.881	28331.922
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	60911.424	28374.770	32536.654
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	60911.424	28374.770	32536.654
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	66402.799	30932.853	35469.945
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	58578.385	27287.955	31290.430
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	60910.653	28374.411	32536.242
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	61758.190	28769.224	32988.965
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	63223.568	29451.851	33771.717
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	68369.951	31849.225	36520.726
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	129826.764	60478.057	69348.707
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	127230.992	59268.851	67962.140
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	103869.045	48386.002	55483.044

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	143906.878	67037.089	76869.789
62	B747-200C	362800	800000	94.10%	2	4	42674.35	140583.634	65489.001	75094.634
63	B747-200F	356000	785000	94.00%	2	4	41830	137802.062	64193.243	73608.819
64	B747-300	340100	750000	92.50%	2	4	39324.0625	129546.663	60347.575	69199.087
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	103644.948	48281.609	55363.339
66	B747-300	377800	833000	92.50%	2	4	43683.125	143906.878	67037.089	76869.789
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	143906.878	67037.089	76869.789
68	B747-SP	315600	698000	87.80%	2	4	34637.1	114106.235	53154.859	60951.376
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	76243.714	35517.112	40726.603
70	B747-8	447696	987000	94.70%	4	4	26498.007	87293.330	40664.427	46628.903
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	85867.803	40000.364	45867.438
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	43432.851	20232.611	23200.240
73	B757-300	122470	270000	92.70%	2	4	14191.21125	46750.614	21778.146	24972.467
74	B767-200	142882	315000	92.60%	2	4	16538.5915	54483.672	25380.488	29103.184
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	66992.561	31207.586	35784.975
76	B767-300	158758	350000	92.70%	2	4	18396.08325	60602.874	28231.036	32371.838
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	71030.094	33088.417	37941.677
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	71030.094	33088.417	37941.677
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	79010.128	36805.809	42204.320
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	73012.444	34011.868	39000.576
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	73012.444	34011.868	39000.576
82	B777-300	299370	660000	92.30%	2	6	23026.5425	75857.161	35337.041	40520.120
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	87563.700	40790.375	46773.324
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	89171.721	41539.450	47632.271
85	B777-F	347815	766800	91.70%	2	6	26578.86292	87559.697	40788.510	46771.186
86	B777-9	351535	775000	94.20%	2	6	27595.4975	90908.832	42348.660	48560.172
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	90908.832	42348.660	48560.172
88	B787-8	227930	502500	91.20%	2	4	25984.02	85600.084	39875.651	45724.433
89	B787-9	254011	560000	92.30%	2	4	29306.51913	96545.512	44974.432	51571.080
90	B787-10	254011	560000	93.20%	2	4	29592.2815	97486.909	45412.969	52073.940
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	51338.104	23915.167	27422.937
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	53211.757	24787.984	28423.774
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	56209.603	26184.490	30025.113
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	61830.563	28802.939	33027.624
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	61830.563	28802.939	33027.624
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	64276.607	29942.395	34334.212
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	66419.161	30940.475	35478.685
98	A310-200	132000	291009	93.70%	2	2	30921	101864.154	47452.050	54412.104
99	A310-300	150000	330693	94.50%	2	2	35437.5	116743.021	54383.171	62359.850
100	A318-100	68000	149914	90.80%	2	2	15436	50851.366	23688.427	27162.939
101	A319-100	64000	141096	92.70%	2	2	14832	48861.587	22761.515	26100.072
102	A319-Neo	64000	141096	90.80%	2	2	14528	47860.109	22294.990	25565.119
103	A320-200	78000	171961	95.10%	2	2	18544.5	61091.808	28458.800	32633.009
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	61614.784	28702.421	32912.363
105	A321-100	89000	196211	95.00%	2	2	21137.5	69634.021	32438.075	37195.946
106	A321-200	93500	206132	95.30%	2	2	22276.375	73385.857	34185.817	39200.040
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	75893.258	35353.857	40539.402
108	A330-200	242000	535519	92.70%	2	4	28041.75	92378.938	43033.489	49345.449
109	A330-200F	233000	513677	94.70%	2	4	27581.375	90862.308	42326.988	48535.320
110	A330-300	242000	535519	93.80%	2	4	28374.5	93475.128	43544.135	49930.993
111	A330-800	242000	533519	92.80%	2	4	28072	92478.592	43079.912	49398.680
112	A330-900	242000	533519	93.90%	2	4	28404.75	93574.782	43590.557	49984.225
113	A340-200	275000	606271	93.50%	2	4	32140.625	105882.008	49323.713	56558.295
114	A340-300	276500	609578	93.80%	2	4	32419.625	106801.128	49751.873	57049.255
115	A340-500	380000	837756	93.50%	3	4	29608.33333	97539.789	45437.603	52102.187
116	A340-600	380000	837756	92.30%	3	4	29228.33333	96287.942	44854.446	51433.495
117	A350-900	280000	617295	93.10%	2	4	32585	107345.928	50005.661	57340.267
118	A350-1000	308000	679024	94.20%	2	6	24178	79650.448	37104.093	42546.355
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	74427.965	34671.270	39756.696

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	29811.185	13887.141	15924.044
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	33004.961	15374.918	17630.043
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	34601.849	16118.807	18483.042
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	33714.602	15705.495	18009.107
124	Avro RJ85	44000	97000	95.00%	2	2	10450	34425.808	16036.801	18389.007
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	36021.914	16780.325	19241.588
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13787.586	6422.762	7364.824
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14639.329	6819.535	7819.794
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15296.012	7125.442	8170.570
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15296.012	7125.442	8170.570
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	17105.834	7968.523	9137.311
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	17105.834	7968.523	9137.311
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4791.053	2231.848	2559.205
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5323.392	2479.831	2843.561
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6104.156	2843.539	3260.617
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6494.539	3025.394	3469.145
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7222.069	3364.304	3857.765
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7630.196	3554.424	4075.771
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7630.196	3554.424	4075.771
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16839.697	7844.547	8995.150
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18809.010	8761.925	10047.085
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	25906.985	12068.422	13838.564
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32579.333	15176.645	17402.688
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9858.922	4592.647	5266.276
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	12049.033	5612.880	6436.152
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12674.957	5904.459	6770.498
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8922.005	4156.197	4765.809
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12252.458	5707.643	6544.815
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10945.842	5098.974	5846.868
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	10114.146	4711.539	5402.607
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4436.235	2066.560	2369.674
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15615.234	7274.147	8341.086
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	22890.815	10663.379	12227.436
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14865.690	6924.982	7940.708
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	39354.958	18332.979	21021.978
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	15968.880	7438.889	8529.992
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	25906.985	12068.422	13838.564
157	F-50	18990	41866	95.00%	2	2	4510.125	14857.866	6921.338	7936.528
158	F-70	39915	87998	95.00%	2	2	9479.8125	31229.685	14547.930	16681.755
159	F-100	43090	94997	95.00%	2	2	10233.875	33713.820	15705.131	18008.689
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10921.588	5087.675	5833.912
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	14018.345	6530.258	7488.087
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3797.793	1769.151	2028.642
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3761.802	1752.385	2009.417
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4436.235	2066.560	2369.674
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4391.638	2045.786	2345.852
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4922.108	2292.898	2629.210
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5901.679	2749.218	3152.461
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5972.878	2782.385	3190.493
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	5004.261	2331.168	2673.093
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4205.425	1959.041	2246.384
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3690.603	1719.218	1971.385
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3067.809	1429.098	1638.711
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5358.690	2496.274	2862.416
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5785.101	2694.912	3090.189
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5642.703	2628.577	3014.125
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7097.976	3306.497	3791.479
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7808.399	3637.438	4170.961
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7808.399	3637.438	4170.961
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8162.829	3802.544	4360.284
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7169.175	3339.664	3829.511
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7169.175	3339.664	3829.511

j. Kemiringan 10° (g = 17,6 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14510.285	7525.161	6985.124
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14510.285	7525.161	6985.124
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17786.801	9224.391	8562.410
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17786.801	9224.391	8562.410
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31419.349	16294.350	15124.999
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	34640.632	17964.936	16675.697
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37412.097	19402.241	18009.855
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37412.097	19402.241	18009.855
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	39490.886	20480.320	19010.566
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	41915.631	21737.814	20177.817
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	48497.191	25151.068	23346.123
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	112583.010	58386.536	54196.474
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	122974.665	63775.739	59198.926
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	74477.856	38624.869	35852.987
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	98195.623	50925.111	47270.512
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	98195.623	50925.111	47270.512
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	106601.447	55284.445	51317.002
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	111552.886	57852.305	53700.582
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	106601.447	55284.445	51317.002
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	106601.447	55284.445	51317.002
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	106601.447	55284.445	51317.002
22	MD-81	63504	140000	92.40%	2	2	14669.424	48185.065	24989.197	23195.868
23	MD-82	67812	149500	92.40%	2	2	15664.572	51453.855	26684.420	24769.435
24	MD-83	72575	160000	92.40%	2	2	16764.825	55067.886	28558.689	26509.198
25	MD-87	63503	140000	92.40%	2	2	14669.193	48184.306	24988.803	23195.502
26	MD-88	67812	149500	92.40%	2	2	15664.572	51453.855	26684.420	24769.435
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	28030.737	14536.986	13493.751
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	30187.313	15655.405	14531.908
29	B707-120B	117000	257340	97.30%	2	4	14230.125	46742.087	24240.856	22501.231
30	B707-320	141700	312000	96.00%	2	4	17004	55853.511	28966.121	26887.391
31	B707-420	141700	312000	96.00%	2	4	17004	55853.511	28966.121	26887.391
32	B707-320B	148500	327000	96.00%	2	4	17820	58533.849	30356.167	28177.682
33	B707-320C	151500	333600	96.00%	2	4	18180	59716.351	30969.423	28746.928
34	B717-200	54884	121000	96.00%	2	2	13172.16	43266.960	22438.625	20828.335
35	B720	104000	229300	95.00%	2	4	12350	40566.388	21038.084	19528.304
36	B720B	106200	234300	95.00%	2	4	12611.25	41424.523	21483.121	19941.402
37	B727-100	76700	169000	95.40%	2	2	18292.95	60087.361	31161.832	28925.529
38	B727-100C	76700	169000	95.40%	2	2	18292.95	60087.361	31161.832	28925.529
39	B727-200	95100	209500	93.00%	2	2	22110.75	72627.795	37665.411	34962.384
40	B737-100	50349	110000	92.30%	2	2	11618.03175	38162.072	19791.185	18370.887
41	B737-200	52390	115000	93.70%	2	2	12272.3575	40311.354	20905.821	19405.532
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	40311.354	20905.821	19405.532
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	43802.165	22716.187	21085.978
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	44708.746	23186.348	21522.398
45	B737-300	63276	139500	90.80%	2	2	14363.652	47180.687	24468.318	22712.369
46	B737-400	68039	150000	93.80%	2	2	15955.1455	52408.310	27179.409	25228.901
47	B737-500	61689	136000	92.30%	2	2	14234.73675	46757.235	24248.712	22508.523
48	B737-600	65544	144500	91.60%	2	2	15009.576	49302.371	25568.642	23733.729
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	52885.113	27426.683	25458.430
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	60733.776	31497.069	29236.707
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	60733.776	31497.069	29236.707
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	66209.135	34336.638	31872.497
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	58407.541	30290.663	28116.878
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	60733.007	31496.670	29236.337
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	61578.072	31934.928	29643.144
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	63039.177	32692.670	30346.507
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	68170.551	35353.845	32816.705
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	129448.124	67132.932	62315.192
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	126859.923	65790.668	61069.255
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	103566.112	53710.294	49855.818

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	143487.174	74413.706	69073.468
62	B747-200C	362800	800000	94.10%	2	4	42674.35	140173.623	72695.270	67478.353
63	B747-200F	356000	785000	94.00%	2	4	41830	137400.163	71256.929	66143.234
64	B747-300	340100	750000	92.50%	2	4	39324.0625	129168.840	66988.093	62180.747
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	103342.668	53594.414	49748.255
66	B747-300	377800	833000	92.50%	2	4	43683.125	143487.174	74413.706	69073.468
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	143487.174	74413.706	69073.468
68	B747-SP	315600	698000	87.80%	2	4	34637.1	113773.445	59003.906	54769.539
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	76021.350	39425.339	36596.011
70	B747-8	447696	987000	94.70%	4	4	26498.007	87038.740	45139.053	41899.686
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	85617.370	44401.918	41215.451
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	43306.180	22458.964	20847.215
73	B757-300	122470	270000	92.70%	2	4	14191.21125	46614.266	24174.567	22439.699
74	B767-200	142882	315000	92.60%	2	4	16538.5915	54324.771	28173.302	26151.468
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	66797.178	34641.602	32155.576
76	B767-300	158758	350000	92.70%	2	4	18396.08325	60426.126	31337.519	29088.607
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	70822.935	36729.395	34093.540
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	70822.935	36729.395	34093.540
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	78779.696	40855.841	37923.855
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	72799.504	37754.461	35045.043
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	72799.504	37754.461	35045.043
82	B777-300	299370	660000	92.30%	2	6	23026.5425	75635.924	39225.453	36410.471
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	87308.321	45278.860	42029.460
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	88911.652	46110.362	42801.290
85	B777-F	347815	766800	91.70%	2	6	26578.86292	87304.329	45276.791	42027.539
86	B777-9	351535	775000	94.20%	2	6	27595.4975	90643.697	47008.616	43635.081
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	90643.697	47008.616	43635.081
88	B787-8	227930	502500	91.20%	2	4	25984.02	85350.432	44263.482	41086.950
89	B787-9	254011	560000	92.30%	2	4	29306.51913	96263.937	49923.322	46340.616
90	B787-10	254011	560000	93.20%	2	4	29592.2815	97202.589	50410.115	46792.474
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	51188.377	26546.741	24641.636
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	53056.565	27515.600	25540.965
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	56045.668	29065.775	26979.893
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	61650.235	31972.352	29677.882
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	61650.235	31972.352	29677.882
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	64089.145	33237.192	30851.952
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	66225.450	34345.099	31880.351
98	A310-200	132000	291009	93.70%	2	2	30921	101567.068	52673.572	48893.496
99	A310-300	150000	330693	94.50%	2	2	35437.5	116402.541	60367.378	56035.163
100	A318-100	68000	149914	90.80%	2	2	15436	50703.058	26295.050	24408.008
101	A319-100	64000	141096	92.70%	2	2	14832	48719.082	25266.143	23452.939
102	A319-Neo	64000	141096	90.80%	2	2	14528	47720.525	24748.283	22972.242
103	A320-200	78000	171961	95.10%	2	2	18544.5	60913.634	31590.345	29323.290
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	61435.085	31860.774	29574.311
105	A321-100	89000	196211	95.00%	2	2	21137.5	69430.933	36007.491	33423.443
106	A321-200	93500	206132	95.30%	2	2	22276.375	73171.828	37947.551	35224.276
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	75671.916	39244.119	36427.797
108	A330-200	242000	535519	92.70%	2	4	28041.75	92109.515	47768.802	44340.713
109	A330-200F	233000	513677	94.70%	2	4	27581.375	90597.309	46984.559	43612.750
110	A330-300	242000	535519	93.80%	2	4	28374.5	93202.508	48335.638	44866.870
111	A330-800	242000	533519	92.80%	2	4	28072	92208.878	47820.333	44388.546
112	A330-900	242000	533519	93.90%	2	4	28404.75	93301.871	48387.168	44914.703
113	A340-200	275000	606271	93.50%	2	4	32140.625	105573.204	54751.189	50822.015
114	A340-300	276500	609578	93.80%	2	4	32419.625	106489.643	55226.462	51263.180
115	A340-500	380000	837756	93.50%	3	4	29608.33333	97255.315	50437.459	46817.856
116	A340-600	380000	837756	92.30%	3	4	29228.33333	96007.118	49790.133	46216.985
117	A350-900	280000	617295	93.10%	2	4	32585	107032.855	55508.177	51524.678
118	A350-1000	308000	679024	94.20%	2	6	24178	79418.148	41186.948	38231.200
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	74210.897	38486.422	35724.475

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	29724.241	15415.252	14308.989
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	32908.702	17066.741	15841.961
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	34500.933	17892.486	16608.447
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	33616.274	17433.694	16182.579
124	Avro RJ85	44000	97000	95.00%	2	2	10450	34325.405	17801.456	16523.949
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	35916.856	18626.796	17290.060
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13747.374	7129.509	6617.866
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14596.633	7569.942	7026.691
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15251.402	7909.511	7341.891
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15251.402	7909.511	7341.891
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	17055.945	8845.362	8210.582
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	17055.945	8845.362	8210.582
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4777.080	2477.436	2299.644
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5307.867	2752.706	2555.160
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6086.354	3156.436	2929.917
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6475.597	3358.302	3117.296
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7201.006	3734.505	3466.501
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7607.942	3945.545	3662.397
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7607.942	3945.545	3662.397
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16790.584	8707.744	8082.840
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18754.153	9726.068	9028.085
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	25831.428	13396.405	12435.023
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32484.315	16846.651	15637.665
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9830.169	5098.012	4732.157
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	12013.892	6230.510	5783.382
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12637.990	6554.172	6083.818
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8895.984	4613.536	4282.449
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12216.724	6335.700	5881.024
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10913.919	5660.054	5253.865
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	10084.648	5229.987	4854.661
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4423.297	2293.960	2129.336
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15569.692	8074.579	7495.113
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	22824.054	11836.755	10987.300
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14822.334	7686.992	7135.342
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	39240.179	20350.301	18889.878
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	15922.307	8257.448	7664.859
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	25831.428	13396.405	12435.023
157	F-50	18990	41866	95.00%	2	2	4510.125	14814.533	7682.947	7131.586
158	F-70	39915	87998	95.00%	2	2	9479.8125	31138.603	16148.753	14989.851
159	F-100	43090	94997	95.00%	2	2	10233.875	33615.494	17433.290	16182.204
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10889.735	5647.512	5242.223
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	13977.461	7248.834	6728.627
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3786.716	1963.824	1822.892
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3750.831	1945.214	1805.617
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4423.297	2293.960	2129.336
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4378.830	2270.899	2107.930
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4907.753	2545.204	2362.549
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5884.467	3051.736	2832.731
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5955.458	3088.553	2866.905
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	4989.666	2587.684	2401.981
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4193.160	2174.610	2018.551
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3679.839	1908.397	1771.442
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3058.862	1586.352	1472.509
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5343.061	2770.958	2572.103
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5768.228	2991.454	2776.775
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5626.246	2917.820	2708.425
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7077.274	3670.337	3406.938
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7785.626	4037.694	3747.932
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7785.626	4037.694	3747.932
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8139.022	4220.968	3918.054
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7148.266	3707.153	3441.112
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7148.266	3707.153	3441.112

k. Kemiringan 11° (g = 19,4 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14463.422	8268.837	6194.585
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14463.422	8268.837	6194.585
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17729.356	10135.993	7593.363
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17729.356	10135.993	7593.363
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31317.876	17904.642	13413.234
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	34528.756	19740.324	14788.432
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37291.269	21319.672	15971.597
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37291.269	21319.672	15971.597
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	39363.345	22504.292	16859.053
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	41780.259	23886.058	17894.201
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	48340.563	27636.628	20703.935
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	112219.408	64156.598	48062.810
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	122577.502	70078.390	52499.112
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	74237.320	42441.980	31795.340
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	97878.487	55957.796	41920.691
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	97878.487	55957.796	41920.691
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	106257.163	60747.942	45509.221
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	111192.611	63569.571	47623.040
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	106257.163	60747.942	45509.221
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	106257.163	60747.942	45509.221
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	106257.163	60747.942	45509.221
22	MD-81	63504	140000	92.40%	2	2	14669.424	48029.444	27458.760	20570.685
23	MD-82	67812	149500	92.40%	2	2	15664.572	51287.678	29321.514	21966.164
24	MD-83	72575	160000	92.40%	2	2	16764.825	54890.037	31381.007	23509.030
25	MD-87	63503	140000	92.40%	2	2	14669.193	48028.688	27458.327	20570.361
26	MD-88	67812	149500	92.40%	2	2	15664.572	51287.678	29321.514	21966.164
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	27940.208	15973.607	11966.601
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	30089.819	17202.554	12887.265
29	B707-120B	117000	257340	97.30%	2	4	14230.125	46591.127	26636.464	19954.663
30	B707-320	141700	312000	96.00%	2	4	17004	55673.125	31828.704	23844.421
31	B707-420	141700	312000	96.00%	2	4	17004	55673.125	31828.704	23844.421
32	B707-320B	148500	327000	96.00%	2	4	17820	58344.806	33356.122	24988.684
33	B707-320C	151500	333600	96.00%	2	4	18180	59523.489	34029.983	25493.506
34	B717-200	54884	121000	96.00%	2	2	13172.16	43127.223	24656.127	18471.097
35	B720	104000	229300	95.00%	2	4	12350	40435.373	23117.178	17318.196
36	B720B	106200	234300	95.00%	2	4	12611.25	41290.737	23606.195	17684.542
37	B727-100	76700	169000	95.40%	2	2	18292.95	59893.301	34241.407	25651.894
38	B727-100C	76700	169000	95.40%	2	2	18292.95	59893.301	34241.407	25651.894
39	B727-200	95100	209500	93.00%	2	2	22110.75	72393.233	41387.703	31005.530
40	B737-100	50349	110000	92.30%	2	2	11618.03175	38038.822	21747.053	16291.769
41	B737-200	52390	115000	93.70%	2	2	12272.3575	40181.163	22971.844	17209.319
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	40181.163	22971.844	17209.319
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	43660.700	24961.119	18699.581
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	44564.353	25477.743	19086.610
45	B737-300	63276	139500	90.80%	2	2	14363.652	47028.310	26886.404	20141.906
46	B737-400	68039	150000	93.80%	2	2	15955.1455	52239.050	29865.420	22373.630
47	B737-500	61689	136000	92.30%	2	2	14234.73675	46606.226	26645.096	19961.130
48	B737-600	65544	144500	91.60%	2	2	15009.576	49143.143	28095.468	21047.674
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	52714.313	30137.131	22577.182
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	60537.628	34609.773	25927.855
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	60537.628	34609.773	25927.855
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	65995.304	37729.963	28265.340
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	58218.906	33284.144	24934.762
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	60536.862	34609.335	25927.527
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	61379.198	35090.904	26288.293
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	62835.583	35923.530	26912.054
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	67950.385	38847.696	29102.688
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	129030.054	73767.358	55262.696
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	126450.212	72292.445	54157.767
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	103231.631	59018.225	44213.407

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	143023.763	81767.657	61256.106
62	B747-200C	362800	800000	94.10%	2	4	42674.35	139720.913	79879.395	59841.518
63	B747-200F	356000	785000	94.00%	2	4	41830	136956.411	78298.910	58657.501
64	B747-300	340100	750000	92.50%	2	4	39324.0625	128751.672	73608.205	55143.467
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	103008.909	58890.893	44118.016
66	B747-300	377800	833000	92.50%	2	4	43683.125	143023.763	81767.657	61256.106
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	143023.763	81767.657	61256.106
68	B747-SP	315600	698000	87.80%	2	4	34637.1	113405.998	64834.979	48571.019
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	75775.829	43321.556	32454.273
70	B747-8	447696	987000	94.70%	4	4	26498.007	86757.636	49599.930	37157.706
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	85340.857	48789.947	36550.909
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	43166.316	24678.476	18487.840
73	B757-300	122470	270000	92.70%	2	4	14191.21125	46463.719	26563.624	19900.095
74	B767-200	142882	315000	92.60%	2	4	16538.5915	54149.322	30957.535	23191.787
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	66581.447	38065.066	28516.382
76	B767-300	158758	350000	92.70%	2	4	18396.08325	60230.971	34434.455	25796.516
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	70594.203	40359.185	30235.018
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	70594.203	40359.185	30235.018
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	78525.266	44893.428	33631.838
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	72564.388	41485.553	31078.835
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	72564.388	41485.553	31078.835
82	B777-300	299370	660000	92.30%	2	6	23026.5425	75391.647	43101.917	32289.731
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	87026.347	49753.553	37272.793
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	88624.500	50667.228	37957.271
85	B777-F	347815	766800	91.70%	2	6	26578.86292	87022.368	49751.279	37271.089
86	B777-9	351535	775000	94.20%	2	6	27595.4975	90350.951	51654.252	38696.699
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	90350.951	51654.252	38696.699
88	B787-8	227930	502500	91.20%	2	4	25984.02	85074.782	48637.830	36436.951
89	B787-9	254011	560000	92.30%	2	4	29306.51913	95953.040	54857.005	41096.035
90	B787-10	254011	560000	93.20%	2	4	29592.2815	96888.660	55391.905	41496.755
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	51023.057	29170.228	21852.829
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	52885.212	30234.835	22650.377
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	55864.661	31938.206	23926.455
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	61451.127	35132.027	26319.100
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	61451.127	35132.027	26319.100
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	63882.160	36521.865	27360.295
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	66011.566	37739.260	28272.305
98	A310-200	132000	291009	93.70%	2	2	30921	101239.043	57879.049	43359.995
99	A310-300	150000	330693	94.50%	2	2	35437.5	116026.603	66333.197	49693.406
100	A318-100	68000	149914	90.80%	2	2	15436	50539.306	28893.664	21645.641
101	A319-100	64000	141096	92.70%	2	2	14832	48561.738	27763.075	20798.662
102	A319-Neo	64000	141096	90.80%	2	2	14528	47566.405	27194.037	20372.368
103	A320-200	78000	171961	95.10%	2	2	18544.5	60716.906	34712.267	26004.638
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	61236.672	35009.421	26227.251
105	A321-100	89000	196211	95.00%	2	2	21137.5	69206.697	39565.939	29640.758
106	A321-200	93500	206132	95.30%	2	2	22276.375	72935.509	41697.726	31237.783
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	75427.524	43122.427	32305.096
108	A330-200	242000	535519	92.70%	2	4	28041.75	91812.035	52489.564	39322.471
109	A330-200F	233000	513677	94.70%	2	4	27581.375	90304.712	51627.817	38676.895
110	A330-300	242000	535519	93.80%	2	4	28374.5	92901.498	53112.418	39789.081
111	A330-800	242000	533519	92.80%	2	4	28072	91911.077	52546.187	39364.890
112	A330-900	242000	533519	93.90%	2	4	28404.75	93000.540	53169.041	39831.500
113	A340-200	275000	606271	93.50%	2	4	32140.625	105232.241	60161.987	45070.254
114	A340-300	276500	609578	93.80%	2	4	32419.625	106145.720	60684.229	45461.491
115	A340-500	380000	837756	93.50%	3	4	29608.33333	96941.216	55421.951	41519.264
116	A340-600	380000	837756	92.30%	3	4	29228.33333	95697.050	54710.654	40986.397
117	A350-900	280000	617295	93.10%	2	4	32585	106687.178	60993.784	45693.394
118	A350-1000	308000	679024	94.20%	2	6	24178	79161.657	45257.257	33904.400
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	73971.223	42289.850	31681.372

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	29628.242	16938.667	12689.575
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	32802.419	18753.366	14049.053
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	34389.508	19660.715	14728.793
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	33507.705	19156.583	14351.123
124	Avro RJ85	44000	97000	95.00%	2	2	10450	34214.547	19560.689	14653.858
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	35800.858	20467.593	15333.264
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13702.975	7834.084	5868.891
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14549.491	8318.043	6231.448
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15202.145	8691.170	6510.976
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15202.145	8691.170	6510.976
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	17000.860	9719.507	7281.353
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	17000.860	9719.507	7281.353
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4761.652	2722.269	2039.383
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5290.724	3024.743	2265.981
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6066.697	3468.372	2598.325
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6454.683	3690.186	2764.497
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7177.749	4103.568	3074.181
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7583.371	4335.465	3247.906
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7583.371	4335.465	3247.906
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16736.357	9568.289	7168.068
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18693.584	10687.249	8006.335
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	25748.002	14720.307	11027.694
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32379.403	18511.525	13867.878
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9798.421	5601.824	4196.597
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	11975.091	6846.241	5128.850
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12597.174	7201.890	5395.284
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8867.254	5069.469	3797.785
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12177.268	6961.827	5215.441
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10878.671	6219.410	4659.261
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	10052.078	5746.841	4305.237
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4409.011	2520.661	1888.349
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15519.407	8872.551	6646.857
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	22750.341	13006.524	9743.816
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14774.463	8446.661	6327.802
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	39113.448	22361.424	16752.024
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	15870.884	9073.492	6797.392
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	25748.002	14720.307	11027.694
157	F-50	18990	41866	95.00%	2	2	4510.125	14766.687	8442.215	6324.472
158	F-70	39915	87998	95.00%	2	2	9479.8125	31038.037	17744.657	13293.381
159	F-100	43090	94997	95.00%	2	2	10233.875	33506.928	19156.138	14350.790
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10854.565	6205.629	4648.936
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	13932.319	7965.201	5967.118
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3774.487	2157.900	1616.587
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3738.717	2137.450	1601.267
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4409.011	2520.661	1888.349
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4364.688	2495.321	1869.366
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4891.903	2796.734	2095.169
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5865.462	3353.324	2512.138
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5936.224	3393.779	2542.444
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	4973.551	2843.413	2130.138
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4179.618	2389.516	1790.102
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3667.955	2096.995	1570.960
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3048.983	1743.124	1305.859
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5325.805	3044.799	2281.006
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5749.599	3287.085	2462.514
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5608.075	3206.175	2401.901
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7054.417	4033.058	3021.359
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7760.481	4436.720	3323.761
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7760.481	4436.720	3323.761
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8112.736	4638.106	3474.630
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7125.179	4073.513	3051.666
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7125.179	4073.513	3051.666

l. Kemiringan 12° (g = 21,2 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14412.153	9009.993	5402.160
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14412.153	9009.993	5402.160
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17666.511	11044.508	6622.003
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17666.511	11044.508	6622.003
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31206.863	19509.481	11697.382
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	34406.361	21509.700	12896.662
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37159.083	23230.608	13928.474
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37159.083	23230.608	13928.474
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	39223.813	24521.409	14702.405
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	41632.160	26027.026	15605.134
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	48169.209	30113.769	18055.440
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	111821.623	69907.117	41914.506
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	122143.000	76359.695	45783.306
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	73974.170	46246.162	27728.008
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	97531.536	60973.435	36558.101
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	97531.536	60973.435	36558.101
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	105880.512	66192.934	39687.578
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	110798.466	69267.473	41530.993
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	105880.512	66192.934	39687.578
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	105880.512	66192.934	39687.578
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	105880.512	66192.934	39687.578
22	MD-81	63504	140000	92.40%	2	2	14669.424	47859.194	29919.958	17939.236
23	MD-82	67812	149500	92.40%	2	2	15664.572	51105.878	31949.675	19156.202
24	MD-83	72575	160000	92.40%	2	2	16764.825	54695.468	34193.767	20501.701
25	MD-87	63503	140000	92.40%	2	2	14669.193	47858.440	29919.487	17938.953
26	MD-88	67812	149500	92.40%	2	2	15664.572	51105.878	31949.675	19156.202
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	27841.168	17405.362	10435.806
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	29983.159	18744.463	11238.697
29	B707-120B	117000	257340	97.30%	2	4	14230.125	46425.975	29023.958	17402.017
30	B707-320	141700	312000	96.00%	2	4	17004	55475.780	34681.591	20794.189
31	B707-420	141700	312000	96.00%	2	4	17004	55475.780	34681.591	20794.189
32	B707-320B	148500	327000	96.00%	2	4	17820	58137.991	36345.916	21792.075
33	B707-320C	151500	333600	96.00%	2	4	18180	59312.496	37080.177	22232.319
34	B717-200	54884	121000	96.00%	2	2	13172.16	42974.350	26866.118	16108.232
35	B720	104000	229300	95.00%	2	4	12350	40292.042	25189.229	15102.813
36	B720B	106200	234300	95.00%	2	4	12611.25	41144.373	25722.078	15422.295
37	B727-100	76700	169000	95.40%	2	2	18292.95	59680.996	37310.551	22370.445
38	B727-100C	76700	169000	95.40%	2	2	18292.95	59680.996	37310.551	22370.445
39	B727-200	95100	209500	93.00%	2	2	22110.75	72136.621	45097.388	27039.232
40	B737-100	50349	110000	92.30%	2	2	11618.03175	37903.986	23696.297	14207.689
41	B737-200	52390	115000	93.70%	2	2	12272.3575	40038.732	25030.868	15007.864
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	40038.732	25030.868	15007.864
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	43505.936	27198.447	16307.488
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	44406.385	27761.378	16645.007
45	B737-300	63276	139500	90.80%	2	2	14363.652	46861.609	29296.301	17565.307
46	B737-400	68039	150000	93.80%	2	2	15955.1455	52053.878	32542.333	19511.545
47	B737-500	61689	136000	92.30%	2	2	14234.73675	46441.021	29033.364	17407.657
48	B737-600	65544	144500	91.60%	2	2	15009.576	48968.944	30613.737	18355.208
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	52527.456	32838.398	19689.058
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	60323.040	37711.935	22611.105
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	60323.040	37711.935	22611.105
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	65761.370	41111.796	24649.574
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	58012.537	36267.487	21745.051
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	60322.276	37711.458	22610.818
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	61161.626	38236.191	22925.435
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	62612.849	39143.447	23469.402
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	67709.520	42329.714	25379.806
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	128572.680	80379.314	48193.366
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	126001.983	78772.201	47229.782
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	102865.705	64308.178	38557.527

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	142516.785	89096.700	53420.086
62	B747-200C	362800	800000	94.10%	2	4	42674.35	139225.643	87039.188	52186.455
63	B747-200F	356000	785000	94.00%	2	4	41830	136470.940	85317.041	51153.899
64	B747-300	340100	750000	92.50%	2	4	39324.0625	128295.285	80205.896	48089.389
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	102643.773	64169.433	38474.339
66	B747-300	377800	833000	92.50%	2	4	43683.125	142516.785	89096.700	53420.086
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	142516.785	89096.700	53420.086
68	B747-SP	315600	698000	87.80%	2	4	34637.1	113004.007	70646.303	42357.703
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	75507.226	47204.577	28302.648
70	B747-8	447696	987000	94.70%	4	4	26498.007	86450.106	54045.698	32404.408
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	85038.348	53163.114	31875.234
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	43013.304	26890.471	16122.834
73	B757-300	122470	270000	92.70%	2	4	14191.21125	46299.018	28944.589	17354.430
74	B767-200	142882	315000	92.60%	2	4	16538.5915	53957.378	33732.338	20225.041
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	66345.436	41476.934	24868.501
76	B767-300	158758	350000	92.70%	2	4	18396.08325	60017.470	37520.903	22496.567
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	70343.967	43976.682	26367.285
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	70343.967	43976.682	26367.285
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	78246.917	48917.340	29329.577
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	72307.168	45204.009	27103.159
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	72307.168	45204.009	27103.159
82	B777-300	299370	660000	92.30%	2	6	23026.5425	75124.406	46965.251	28159.155
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	86717.864	54213.091	32504.773
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	88310.352	55208.661	33101.691
85	B777-F	347815	766800	91.70%	2	6	26578.86292	86713.899	54210.613	32503.287
86	B777-9	351535	775000	94.20%	2	6	27595.4975	90030.683	56284.154	33746.529
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	90030.683	56284.154	33746.529
88	B787-8	227930	502500	91.20%	2	4	25984.02	84773.216	52997.363	31775.853
89	B787-9	254011	560000	92.30%	2	4	29306.51913	95612.915	59773.978	35838.937
90	B787-10	254011	560000	93.20%	2	4	29592.2815	96545.218	60356.822	36188.396
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	50842.195	31784.830	19057.365
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	52697.749	32944.860	19752.889
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	55666.637	34800.909	20865.728
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	61233.300	38280.999	22952.301
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	61233.300	38280.999	22952.301
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	63655.717	39795.413	23860.304
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	65777.574	41121.926	24655.648
98	A310-200	132000	291009	93.70%	2	2	30921	100880.180	63066.895	37813.285
99	A310-300	150000	330693	94.50%	2	2	35437.5	115615.322	72278.810	43336.512
100	A318-100	68000	149914	90.80%	2	2	15436	50360.159	31483.477	18876.682
101	A319-100	64000	141096	92.70%	2	2	14832	48389.600	30251.550	18138.050
102	A319-Neo	64000	141096	90.80%	2	2	14528	47397.796	29631.508	17766.289
103	A320-200	78000	171961	95.10%	2	2	18544.5	60501.682	37823.616	22678.066
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	61019.606	38147.405	22872.201
105	A321-100	89000	196211	95.00%	2	2	21137.5	68961.379	43112.334	25849.045
106	A321-200	93500	206132	95.30%	2	2	22276.375	72676.974	45435.199	27241.775
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	75160.155	46987.600	28172.555
108	A330-200	242000	535519	92.70%	2	4	28041.75	91486.588	57194.337	34292.251
109	A330-200F	233000	513677	94.70%	2	4	27581.375	89984.608	56255.350	33729.259
110	A330-300	242000	535519	93.80%	2	4	28374.5	92572.190	57873.019	34699.171
111	A330-800	242000	533519	92.80%	2	4	28072	91585.279	57256.035	34329.244
112	A330-900	242000	533519	93.90%	2	4	28404.75	92670.881	57934.717	34736.164
113	A340-200	275000	606271	93.50%	2	4	32140.625	104859.223	65554.459	39304.765
114	A340-300	276500	609578	93.80%	2	4	32419.625	105769.464	66123.511	39645.954
115	A340-500	380000	837756	93.50%	3	4	29608.33333	96597.587	60389.562	36208.026
116	A340-600	380000	837756	92.30%	3	4	29228.33333	95357.832	59614.509	35743.324
117	A350-900	280000	617295	93.10%	2	4	32585	106309.003	66460.812	39848.191
118	A350-1000	308000	679024	94.20%	2	6	24178	78881.052	49313.780	29567.272
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	73709.016	46080.397	27628.619

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	29523.219	18456.923	11066.296
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	32686.144	20434.278	12251.866
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	34267.607	21422.955	12844.652
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	33388.930	20873.636	12515.294
124	Avro RJ85	44000	97000	95.00%	2	2	10450	34093.266	21313.963	12779.303
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	35673.954	22302.156	13371.798
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13654.402	8536.273	5118.129
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14497.918	9063.610	5434.307
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15148.258	9470.181	5678.077
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15148.258	9470.181	5678.077
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	16940.597	10590.691	6349.906
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	16940.597	10590.691	6349.906
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4744.773	2966.272	1778.501
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5271.970	3295.858	1976.112
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6045.192	3779.251	2265.941
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6431.803	4020.947	2410.856
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7152.306	4471.381	2680.925
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7556.490	4724.064	2832.427
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7556.490	4724.064	2832.427
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16677.031	10425.919	6251.112
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18627.321	11645.174	6982.147
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	25656.732	16039.726	9617.006
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32264.627	20170.760	12093.868
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9763.689	6103.930	3659.759
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	11932.643	7459.887	4472.756
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12552.521	7847.414	4705.107
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8835.822	5523.859	3311.963
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12134.103	7585.833	4548.270
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10840.109	6776.871	4063.238
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	10016.447	6261.945	3754.501
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4393.382	2746.595	1646.787
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15464.396	9667.820	5796.576
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	22669.697	14172.332	8497.365
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14722.092	9203.757	5518.335
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	38974.802	24365.735	14609.067
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	15814.626	9886.772	5927.854
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	25656.732	16039.726	9617.006
157	F-50	18990	41866	95.00%	2	2	4510.125	14714.344	9198.913	5515.431
158	F-70	39915	87998	95.00%	2	2	9479.8125	30928.016	19335.155	11592.861
159	F-100	43090	94997	95.00%	2	2	10233.875	33388.155	20873.152	12515.004
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10816.089	6761.855	4054.234
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	13882.933	8679.143	5203.790
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3761.107	2351.318	1409.789
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3725.464	2329.035	1396.429
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4393.382	2746.595	1646.787
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4349.216	2718.984	1630.232
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4874.562	3047.412	1827.150
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5844.671	3653.891	2190.779
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5915.182	3697.973	2217.209
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	4955.921	3098.275	1857.646
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4164.802	2603.694	1561.108
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3654.953	2284.954	1369.999
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3038.175	1899.365	1138.810
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5306.927	3317.712	1989.215
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5729.218	3581.715	2147.504
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5588.196	3493.552	2094.644
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7029.412	4394.552	2634.860
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7732.973	4834.394	2898.578
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7732.973	4834.394	2898.578
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8083.978	5053.831	3030.147
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7099.923	4438.633	2661.290
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7099.923	4438.633	2661.290

m. Kemiringan 13° (g = 23 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14356.495	9748.406	4608.089
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14356.495	9748.406	4608.089
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17598.284	11949.659	5648.625
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17598.284	11949.659	5648.625
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	31086.345	21108.377	9977.968
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	34273.487	23272.523	11000.963
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	37015.577	25134.469	11881.108
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	37015.577	25134.469	11881.108
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	39072.334	26531.056	12541.278
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	41471.380	28160.066	13311.314
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	47983.183	32581.737	15401.446
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	111389.776	75636.341	35753.434
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	121671.293	82617.739	39053.554
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	73688.487	50036.258	23652.229
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	97154.876	65970.502	31184.375
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	97154.876	65970.502	31184.375
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	105471.609	71617.764	33853.846
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	110370.570	74944.276	35426.294
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	105471.609	71617.764	33853.846
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	105471.609	71617.764	33853.846
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	105471.609	71617.764	33853.846
22	MD-81	63504	140000	92.40%	2	2	14669.424	47674.365	32372.042	15302.323
23	MD-82	67812	149500	92.40%	2	2	15664.572	50908.511	34568.105	16340.405
24	MD-83	72575	160000	92.40%	2	2	16764.825	54484.238	36996.110	17488.128
25	MD-87	63503	140000	92.40%	2	2	14669.193	47673.614	32371.533	15302.082
26	MD-88	67812	149500	92.40%	2	2	15664.572	50908.511	34568.105	16340.405
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	27733.647	18831.815	8901.833
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	29867.367	20280.662	9586.705
29	B707-120B	117000	257340	97.30%	2	4	14230.125	46246.681	31402.611	14844.071
30	B707-320	141700	312000	96.00%	2	4	17004	55261.536	37523.914	17737.622
31	B707-420	141700	312000	96.00%	2	4	17004	55261.536	37523.914	17737.622
32	B707-320B	148500	327000	96.00%	2	4	17820	57913.466	39324.639	18588.827
33	B707-320C	151500	333600	96.00%	2	4	18180	59083.435	40119.076	18964.359
34	B717-200	54884	121000	96.00%	2	2	13172.16	42808.386	29067.925	13740.461
35	B720	104000	229300	95.00%	2	4	12350	40136.437	27253.608	12882.829
36	B720B	106200	234300	95.00%	2	4	12611.25	40985.477	27830.126	13155.351
37	B727-100	76700	169000	95.40%	2	2	18292.95	59450.513	40368.330	19082.182
38	B727-100C	76700	169000	95.40%	2	2	18292.95	59450.513	40368.330	19082.182
39	B727-200	95100	209500	93.00%	2	2	22110.75	71858.034	48793.336	23064.698
40	B737-100	50349	110000	92.30%	2	2	11618.03175	37757.603	25638.322	12119.281
41	B737-200	52390	115000	93.70%	2	2	12272.3575	39884.105	27082.268	12801.837
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	39884.105	27082.268	12801.837
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	43337.919	29427.491	13910.428
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	44234.891	30036.557	14198.334
45	B737-300	63276	139500	90.80%	2	2	14363.652	46680.632	31697.274	14983.358
46	B737-400	68039	150000	93.80%	2	2	15955.1455	51852.849	35209.334	16643.515
47	B737-500	61689	136000	92.30%	2	2	14234.73675	46261.669	31412.788	14848.881
48	B737-600	65544	144500	91.60%	2	2	15009.576	48779.830	33122.680	15657.150
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	52324.599	35529.663	16794.936
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	60090.076	40802.609	19287.467
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	60090.076	40802.609	19287.467
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	65507.404	44481.106	21026.299
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	57788.497	39239.782	18548.715
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	60089.316	40802.093	19287.223
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	60925.424	41369.831	19555.593
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	62371.043	42351.441	20019.602
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	67448.031	45798.838	21649.193
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	128076.142	86966.786	41109.356
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	125515.372	85227.962	40287.411
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	102468.445	69578.543	32889.902

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	141966.396	96398.603	45567.793
62	B747-200C	362800	800000	94.10%	2	4	42674.35	138687.964	94172.469	44515.495
63	B747-200F	356000	785000	94.00%	2	4	41830	135943.899	92309.183	43634.716
64	B747-300	340100	750000	92.50%	2	4	39324.0625	127799.818	86779.155	41020.663
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	102247.370	69428.427	32818.942
66	B747-300	377800	833000	92.50%	2	4	43683.125	141966.396	96398.603	45567.793
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	141966.396	96398.603	45567.793
68	B747-SP	315600	698000	87.80%	2	4	34637.1	112567.593	76436.108	36131.486
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	75215.622	51073.219	24142.403
70	B747-8	447696	987000	94.70%	4	4	26498.007	86116.242	58475.003	27641.239
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	84709.936	57520.088	27189.849
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	42847.190	29094.274	13752.916
73	B757-300	122470	270000	92.70%	2	4	14191.21125	46120.215	31316.737	14803.478
74	B767-200	142882	315000	92.60%	2	4	16538.5915	53748.999	36496.865	17252.134
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	66089.214	44876.169	21213.046
76	B767-300	158758	350000	92.70%	2	4	18396.08325	59785.687	40595.922	19189.765
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	70072.304	47580.782	22491.521
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	70072.304	47580.782	22491.521
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	77944.733	52926.351	25018.381
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	72027.923	48908.695	23119.228
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	72027.923	48908.695	23119.228
82	B777-300	299370	660000	92.30%	2	6	23026.5425	74834.281	50814.280	24020.001
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	86382.965	58656.115	27726.851
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	87969.304	59733.276	28236.027
85	B777-F	347815	766800	91.70%	2	6	26578.86292	86379.016	58653.433	27725.583
86	B777-9	351535	775000	94.20%	2	6	27595.4975	89682.991	60896.912	28786.080
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	89682.991	60896.912	28786.080
88	B787-8	227930	502500	91.20%	2	4	25984.02	84445.828	57340.752	27105.076
89	B787-9	254011	560000	92.30%	2	4	29306.51913	95243.664	64672.743	30570.922
90	B787-10	254011	560000	93.20%	2	4	29592.2815	96172.367	65303.354	30869.013
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	50645.846	34389.750	16256.096
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	52494.234	35644.850	16849.385
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	55451.656	37653.010	17798.646
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	60996.822	41418.311	19578.510
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	60996.822	41418.311	19578.510
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	63409.883	43056.838	20353.045
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	65523.546	44492.066	21031.480
98	A310-200	132000	291009	93.70%	2	2	30921	100490.588	68235.530	32255.058
99	A310-300	150000	330693	94.50%	2	2	35437.5	115168.824	78202.406	36966.418
100	A318-100	68000	149914	90.80%	2	2	15436	50165.671	34063.699	16101.972
101	A319-100	64000	141096	92.70%	2	2	14832	48202.723	32730.810	15471.913
102	A319-Neo	64000	141096	90.80%	2	2	14528	47214.749	32059.952	15154.797
103	A320-200	78000	171961	95.10%	2	2	18544.5	60268.029	40923.443	19344.585
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	60783.952	41273.768	19510.184
105	A321-100	89000	196211	95.00%	2	2	21137.5	68695.055	46645.598	22049.458
106	A321-200	93500	206132	95.30%	2	2	22276.375	72396.301	49158.833	23237.469
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	74869.892	50838.460	24031.432
108	A330-200	242000	535519	92.70%	2	4	28041.75	91133.274	61881.688	29251.585
109	A330-200F	233000	513677	94.70%	2	4	27581.375	89637.094	60865.747	28771.348
110	A330-300	242000	535519	93.80%	2	4	28374.5	92214.682	62615.991	29598.691
111	A330-800	242000	533519	92.80%	2	4	28072	91231.583	61948.443	29283.140
112	A330-900	242000	533519	93.90%	2	4	28404.75	92312.992	62682.746	29630.247
113	A340-200	275000	606271	93.50%	2	4	32140.625	104454.264	70926.962	33527.302
114	A340-300	276500	609578	93.80%	2	4	32419.625	105360.990	71542.651	33818.340
115	A340-500	380000	837756	93.50%	3	4	29608.33333	96224.534	65338.777	30885.757
116	A340-600	380000	837756	92.30%	3	4	29228.33333	94989.567	64500.205	30489.363
117	A350-900	280000	617295	93.10%	2	4	32585	105898.445	71907.595	33990.850
118	A350-1000	308000	679024	94.20%	2	6	24178	78576.419	53355.281	25221.137
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	73424.357	49856.907	23567.450

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	29409.202	19969.557	9439.645
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	32559.913	22108.965	10450.948
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	34135.268	23178.669	10956.599
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	33259.985	22584.331	10675.654
124	Avro RJ85	44000	97000	95.00%	2	2	10450	33961.600	23060.745	10900.856
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	35536.184	24129.925	11406.259
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13601.670	9235.862	4365.808
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14441.928	9806.417	4635.511
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15089.757	10246.308	4843.448
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15089.757	10246.308	4843.448
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	16875.174	11458.650	5416.524
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	16875.174	11458.650	5416.524
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4726.449	3209.373	1517.076
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5251.610	3565.970	1685.640
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	6021.846	4088.979	1932.868
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6406.964	4350.483	2056.481
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7124.684	4837.832	2286.852
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7527.308	5111.223	2416.084
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7527.308	5111.223	2416.084
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16612.626	11280.373	5332.253
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18555.383	12599.552	5955.831
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	25557.648	17354.259	8203.389
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32140.024	21823.850	10316.173
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9725.982	6604.176	3121.806
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	11886.560	8071.261	3815.299
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12504.044	8490.547	4013.497
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8801.698	5976.565	2825.133
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12087.242	8207.529	3879.714
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10798.245	7332.269	3465.977
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	9977.764	6775.142	3202.622
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4376.415	2971.691	1404.724
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15404.673	10460.144	4944.529
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	22582.149	15333.823	7248.326
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14665.237	9958.049	4707.188
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	38824.284	26362.624	12461.660
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	15753.551	10697.041	5056.510
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	25557.648	17354.259	8203.389
157	F-50	18990	41866	95.00%	2	2	4510.125	14657.518	9952.808	4704.710
158	F-70	39915	87998	95.00%	2	2	9479.8125	30808.575	20919.764	9888.810
159	F-100	43090	94997	95.00%	2	2	10233.875	33259.213	22583.807	10675.406
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10774.318	7316.021	3458.296
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	13829.318	9390.440	4438.878
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3746.582	2544.019	1202.563
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3711.077	2519.910	1191.166
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4376.415	2971.691	1404.724
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4332.420	2941.817	1390.602
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4855.737	3297.162	1558.575
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5822.099	3953.345	1868.753
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5892.338	4001.039	1891.298
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	4936.782	3352.194	1584.588
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4148.718	2817.080	1331.639
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3640.838	2472.217	1168.621
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3026.442	2055.027	971.415
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5286.432	3589.615	1696.817
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5707.093	3875.253	1831.839
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5566.615	3779.866	1786.749
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	7002.265	4754.706	2247.558
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7703.108	5230.596	2472.512
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7703.108	5230.596	2472.512
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8052.759	5468.017	2584.741
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7072.503	4802.400	2270.103
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7072.503	4802.400	2270.103

n. Kemiringan 14° (g = 25 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14296.463	10483.849	3812.614
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14296.463	10483.849	3812.614
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17524.696	12851.169	4673.527
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17524.696	12851.169	4673.527
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	30956.357	22700.843	8255.514
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	34130.172	25028.257	9101.914
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	36860.796	27030.672	9830.123
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	36860.796	27030.672	9830.123
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	38908.952	28532.622	10376.331
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	41297.967	30284.528	11013.439
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	47782.541	35039.781	12742.760
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	110923.998	81342.526	29581.472
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	121162.523	88850.617	32311.906
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	73380.358	53811.112	19569.246
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	96748.622	70947.473	25801.149
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	96748.622	70947.473	25801.149
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	105030.579	77020.778	28009.801
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	109909.054	80598.250	29310.804
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	105030.579	77020.778	28009.801
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	105030.579	77020.778	28009.801
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	105030.579	77020.778	28009.801
22	MD-81	63504	140000	92.40%	2	2	14669.424	47475.014	34814.266	12660.748
23	MD-82	67812	149500	92.40%	2	2	15664.572	50695.636	37176.005	13519.631
24	MD-83	72575	160000	92.40%	2	2	16764.825	54256.412	39787.185	14469.227
25	MD-87	63503	140000	92.40%	2	2	14669.193	47474.267	34813.718	12660.549
26	MD-88	67812	149500	92.40%	2	2	15664.572	50695.636	37176.005	13519.631
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	27617.679	20252.531	7365.147
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	29742.476	21810.683	7931.793
29	B707-120B	117000	257340	97.30%	2	4	14230.125	46053.300	33771.698	12281.602
30	B707-320	141700	312000	96.00%	2	4	17004	55030.460	40354.808	14675.652
31	B707-420	141700	312000	96.00%	2	4	17004	55030.460	40354.808	14675.652
32	B707-320B	148500	327000	96.00%	2	4	17820	57671.300	42291.383	15379.918
33	B707-320C	151500	333600	96.00%	2	4	18180	58836.377	43145.754	15690.623
34	B717-200	54884	121000	96.00%	2	2	13172.16	42629.382	31260.879	11368.504
35	B720	104000	229300	95.00%	2	4	12350	39968.606	29309.684	10658.922
36	B720B	106200	234300	95.00%	2	4	12611.25	40814.096	29929.697	10884.399
37	B727-100	76700	169000	95.40%	2	2	18292.95	59201.920	43413.813	15788.107
38	B727-100C	76700	169000	95.40%	2	2	18292.95	59201.920	43413.813	15788.107
39	B727-200	95100	209500	93.00%	2	2	22110.75	71557.559	52474.421	19083.138
40	B737-100	50349	110000	92.30%	2	2	11618.03175	37599.719	27572.538	10027.181
41	B737-200	52390	115000	93.70%	2	2	12272.3575	39717.330	29125.419	10591.911
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	39717.330	29125.419	10591.911
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	43156.701	31647.571	11509.130
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	44049.922	32302.586	11747.337
45	B737-300	63276	139500	90.80%	2	2	14363.652	46485.437	34088.592	12396.845
46	B737-400	68039	150000	93.80%	2	2	15955.1455	51636.026	37865.610	13770.417
47	B737-500	61689	136000	92.30%	2	2	14234.73675	46068.225	33782.643	12285.582
48	B737-600	65544	144500	91.60%	2	2	15009.576	48575.857	35621.533	12954.323
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	52105.803	38210.105	13895.698
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	59838.809	43880.855	15957.954
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	59838.809	43880.855	15957.954
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	65233.484	47836.866	17396.619
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	57546.854	42200.124	15346.730
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	59838.052	43880.300	15957.752
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	60670.664	44490.869	16179.795
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	62110.238	45546.534	16563.704
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	67165.996	49254.011	17911.985
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	127540.590	93527.766	34012.824
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	124990.528	91657.761	33332.767
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	102039.972	74827.713	27212.259

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	141372.762	103671.142	37701.620
62	B747-200C	362800	800000	94.10%	2	4	42674.35	138108.039	101277.063	36830.976
63	B747-200F	356000	785000	94.00%	2	4	41830	135375.448	99273.206	36102.242
64	B747-300	340100	750000	92.50%	2	4	39324.0625	127265.422	93325.981	33939.441
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	101819.821	74666.273	27153.549
66	B747-300	377800	833000	92.50%	2	4	43683.125	141372.762	103671.142	37701.620
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	141372.762	103671.142	37701.620
68	B747-SP	315600	698000	87.80%	2	4	34637.1	112096.891	82202.629	29894.262
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	74901.107	54926.304	19974.803
70	B747-8	447696	987000	94.70%	4	4	26498.007	85756.146	62886.496	22869.650
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	84355.721	61859.539	22496.181
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	42668.024	31289.215	11378.809
73	B757-300	122470	270000	92.70%	2	4	14191.21125	45927.363	33679.346	12248.017
74	B767-200	142882	315000	92.60%	2	4	16538.5915	53524.247	39250.275	14273.972
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	65812.862	48261.733	17551.128
76	B767-300	158758	350000	92.70%	2	4	18396.08325	59535.692	43658.574	15877.118
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	69779.296	51170.390	18608.906
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	69779.296	51170.390	18608.906
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	77618.806	56919.241	20699.565
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	71726.738	52598.483	19128.255
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	71726.738	52598.483	19128.255
82	B777-300	299370	660000	92.30%	2	6	23026.5425	74521.361	54647.829	19873.531
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	86021.754	63081.271	22940.483
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	87601.459	64239.697	23361.762
85	B777-F	347815	766800	91.70%	2	6	26578.86292	86017.822	63078.387	22939.434
86	B777-9	351535	775000	94.20%	2	6	27595.4975	89307.981	65491.119	23816.862
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	89307.981	65491.119	23816.862
88	B787-8	227930	502500	91.20%	2	4	25984.02	84092.717	61666.674	22426.043
89	B787-9	254011	560000	92.30%	2	4	29306.51913	94845.402	69551.808	25293.594
90	B787-10	254011	560000	93.20%	2	4	29592.2815	95770.222	70229.994	25540.227
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	50434.070	36984.194	13449.876
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	52274.729	38333.982	13940.747
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	55219.784	40493.643	14726.142
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	60741.763	44543.007	16198.756
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	60741.763	44543.007	16198.756
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	63144.734	46305.148	16839.586
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	65249.558	47848.653	17400.905
98	A310-200	132000	291009	93.70%	2	2	30921	100070.386	73383.381	26687.005
99	A310-300	150000	330693	94.50%	2	2	35437.5	114687.245	84102.181	30585.063
100	A318-100	68000	149914	90.80%	2	2	15436	49955.903	36633.546	13322.357
101	A319-100	64000	141096	92.70%	2	2	14832	48001.163	35200.100	12801.063
102	A319-Neo	64000	141096	90.80%	2	2	14528	47017.320	34478.631	12538.689
103	A320-200	78000	171961	95.10%	2	2	18544.5	60016.017	44010.805	16005.212
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	60529.784	44387.559	16142.225
105	A321-100	89000	196211	95.00%	2	2	21137.5	68407.806	50164.652	18243.154
106	A321-200	93500	206132	95.30%	2	2	22276.375	72093.575	52867.492	19226.084
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	74556.823	54673.834	19882.988
108	A330-200	242000	535519	92.70%	2	4	28041.75	90752.199	66550.190	24202.009
109	A330-200F	233000	513677	94.70%	2	4	27581.375	89262.276	65457.603	23804.673
110	A330-300	242000	535519	93.80%	2	4	28374.5	91829.086	67339.890	24489.196
111	A330-800	242000	533519	92.80%	2	4	28072	90850.098	66621.981	24228.117
112	A330-900	242000	533519	93.90%	2	4	28404.75	91926.985	67411.681	24515.304
113	A340-200	275000	606271	93.50%	2	4	32140.625	104017.488	76277.860	27739.628
114	A340-300	276500	609578	93.80%	2	4	32419.625	104920.422	76939.998	27980.424
115	A340-500	380000	837756	93.50%	3	4	29608.33333	95822.171	70268.089	25554.081
116	A340-600	380000	837756	92.30%	3	4	29228.33333	94592.367	69366.253	25226.114
117	A350-900	280000	617295	93.10%	2	4	32585	105455.629	77332.475	28123.155
118	A350-1000	308000	679024	94.20%	2	6	24178	78247.851	57380.530	20867.320
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	73117.332	53618.231	19499.102

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	29286.227	21476.108	7810.120
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	32423.763	23776.918	8646.845
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	33992.531	24927.323	9065.208
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	33120.908	24288.146	8832.761
124	Avro RJ85	44000	97000	95.00%	2	2	10450	33819.590	24800.502	9019.087
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	35387.589	25950.344	9437.245
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13544.795	9932.637	3612.158
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14381.539	10546.236	3835.302
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	15026.659	11019.314	4007.345
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	15026.659	11019.314	4007.345
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	16804.610	12323.117	4481.493
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	16804.610	12323.117	4481.493
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4706.685	3451.495	1255.190
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5229.650	3834.995	1394.655
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	5996.666	4397.461	1599.205
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6380.174	4678.694	1701.480
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7094.892	5202.810	1892.083
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7495.832	5496.826	1999.006
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7495.832	5496.826	1999.006
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16543.160	12131.391	4411.769
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18477.794	13550.093	4927.701
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	25450.778	18663.505	6787.273
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	32005.630	23470.293	8535.336
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9685.313	7102.411	2582.902
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	11836.856	8680.176	3156.681
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12451.758	9131.094	3320.664
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8764.894	6427.452	2337.443
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	12036.699	8826.724	3209.975
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10753.092	7885.432	2867.660
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	9936.042	7286.275	2649.767
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4358.115	3195.883	1162.232
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15340.258	11249.282	4090.976
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	22487.721	16490.643	5997.078
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14603.914	10709.308	3894.606
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	38661.940	28351.483	10310.457
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	15687.678	11504.051	4183.627
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	25450.778	18663.505	6787.273
157	F-50	18990	41866	95.00%	2	2	4510.125	14596.227	10703.671	3892.556
158	F-70	39915	87998	95.00%	2	2	9479.8125	30679.748	22498.001	8181.747
159	F-100	43090	94997	95.00%	2	2	10233.875	33120.139	24287.583	8832.556
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10729.265	7867.959	2861.305
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	13771.491	10098.877	3672.613
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3730.916	2735.946	994.969
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3695.559	2710.019	985.540
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4358.115	3195.883	1162.232
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4314.304	3163.755	1150.549
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4835.433	3545.908	1289.525
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5797.754	4251.595	1546.159
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5867.699	4302.887	1564.812
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	4916.139	3605.091	1311.047
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4131.370	3029.607	1101.764
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3625.614	2658.727	966.887
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3013.787	2210.063	803.724
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5264.327	3860.424	1403.903
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5683.228	4167.612	1515.617
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5543.338	4065.028	1478.310
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	6972.984	5113.413	1859.572
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7670.898	5625.205	2045.693
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7670.898	5625.205	2045.693
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	8019.086	5880.537	2138.549
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7042.930	5164.705	1878.225
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7042.930	5164.705	1878.225

o. Kemiringan 15° (g = 26,8 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14232.076	11216.098	3015.978
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14232.076	11216.098	3015.978
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17445.771	13748.765	3697.006
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17445.771	13748.765	3697.006
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	30816.939	24286.394	6530.545
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	33976.460	26776.368	7200.092
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	36694.787	28918.643	7776.144
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	36694.787	28918.643	7776.144
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	38733.719	30525.496	8208.223
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	41111.974	32399.765	8712.209
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	47567.344	37487.151	10080.193
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	110424.432	87023.934	23400.499
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	120616.846	95056.431	25560.415
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	73049.876	57569.575	15480.302
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	96312.898	75902.833	20410.065
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	96312.898	75902.833	20410.065
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	104557.555	82400.330	22157.224
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	109414.059	86227.673	23186.386
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	104557.555	82400.330	22157.224
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	104557.555	82400.330	22157.224
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	104557.555	82400.330	22157.224
22	MD-81	63504	140000	92.40%	2	2	14669.424	47261.202	37245.885	10015.317
23	MD-82	67812	149500	92.40%	2	2	15664.572	50467.319	39772.581	10694.739
24	MD-83	72575	160000	92.40%	2	2	16764.825	54012.058	42566.139	11445.919
25	MD-87	63503	140000	92.40%	2	2	14669.193	47260.458	37245.299	10015.159
26	MD-88	67812	149500	92.40%	2	2	15664.572	50467.319	39772.581	10694.739
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	27493.298	21667.079	5826.219
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	29608.525	23334.060	6274.465
29	B707-120B	117000	257340	97.30%	2	4	14230.125	45845.891	36130.498	9715.393
30	B707-320	141700	312000	96.00%	2	4	17004	54782.620	43173.408	11609.212
31	B707-420	141700	312000	96.00%	2	4	17004	54782.620	43173.408	11609.212
32	B707-320B	148500	327000	96.00%	2	4	17820	57411.567	45245.244	12166.323
33	B707-320C	151500	333600	96.00%	2	4	18180	58571.397	46159.290	12412.107
34	B717-200	54884	121000	96.00%	2	2	13172.16	42437.393	33444.310	8993.084
35	B720	104000	229300	95.00%	2	4	12350	39788.600	31356.833	8431.767
36	B720B	106200	234300	95.00%	2	4	12611.25	40630.282	32020.151	8610.131
37	B727-100	76700	169000	95.40%	2	2	18292.95	58935.293	46446.071	12489.222
38	B727-100C	76700	169000	95.40%	2	2	18292.95	58935.293	46446.071	12489.222
39	B727-200	95100	209500	93.00%	2	2	22110.75	71235.287	56139.522	15095.765
40	B737-100	50349	110000	92.30%	2	2	11618.03175	37430.382	29498.355	7932.027
41	B737-200	52390	115000	93.70%	2	2	12272.3575	39538.456	31159.698	8378.758
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	39538.456	31159.698	8378.758
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	42962.337	33858.010	9104.327
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	43851.536	34558.775	9292.760
45	B737-300	63276	139500	90.80%	2	2	14363.652	46276.081	36469.525	9806.556
46	B737-400	68039	150000	93.80%	2	2	15955.1455	51403.474	40510.351	10893.123
47	B737-500	61689	136000	92.30%	2	2	14234.73675	45860.749	36142.208	9718.541
48	B737-600	65544	144500	91.60%	2	2	15009.576	48357.086	38109.536	10247.550
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	51871.135	40878.908	10992.227
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	59569.314	46945.734	12623.580
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	59569.314	46945.734	12623.580
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	64939.694	51178.054	13761.639
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	57287.681	45147.612	12140.070
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	59568.560	46945.140	12623.420
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	60397.423	47598.355	12799.068
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	61830.513	48727.753	13102.760
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	66863.502	52694.181	14169.322
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	126966.188	100060.258	26905.931
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	124427.611	98059.641	26367.970
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	101580.417	80054.090	21526.327

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	140736.064	110912.102	29823.962
62	B747-200C	362800	800000	94.10%	2	4	42674.35	137486.044	108350.808	29135.237
63	B747-200F	356000	785000	94.00%	2	4	41830	134765.761	106206.990	28558.770
64	B747-300	340100	750000	92.50%	2	4	39324.0625	126692.259	99844.378	26847.881
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	101361.258	79881.374	21479.884
66	B747-300	377800	833000	92.50%	2	4	43683.125	140736.064	110912.102	29823.962
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	140736.064	110912.102	29823.962
68	B747-SP	315600	698000	87.80%	2	4	34637.1	111592.042	87944.111	23647.932
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	74563.777	58762.658	15801.119
70	B747-8	447696	987000	94.70%	4	4	26498.007	85369.928	67278.833	18091.095
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	83975.810	66180.148	17795.661
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	42475.861	33474.625	9001.236
73	B757-300	122470	270000	92.70%	2	4	14191.21125	45720.521	36031.696	9688.825
74	B767-200	142882	315000	92.60%	2	4	16538.5915	53283.191	41991.729	11291.462
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	65516.462	51632.597	13883.865
76	B767-300	158758	350000	92.70%	2	4	18396.08325	59267.563	46707.928	12559.635
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	69465.032	54744.410	14720.623
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	69465.032	54744.410	14720.623
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	77269.236	60894.792	16374.444
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	71403.704	56272.249	15131.454
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	71403.704	56272.249	15131.454
82	B777-300	299370	660000	92.30%	2	6	23026.5425	74185.740	58464.733	15721.007
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	85634.340	67487.212	18147.127
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	87206.930	68726.549	18480.382
85	B777-F	347815	766800	91.70%	2	6	26578.86292	85630.425	67484.127	18146.298
86	B777-9	351535	775000	94.20%	2	6	27595.4975	88905.767	70065.377	18840.389
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	88905.767	70065.377	18840.389
88	B787-8	227930	502500	91.20%	2	4	25984.02	83713.990	65973.812	17740.178
89	B787-9	254011	560000	92.30%	2	4	29306.51913	94418.249	74409.687	20008.562
90	B787-10	254011	560000	93.20%	2	4	29592.2815	95338.903	75135.242	20203.662
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	50206.931	39567.372	10639.559
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	52039.301	41011.437	11027.864
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	54971.092	43321.941	11649.152
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	60468.202	47654.135	12814.067
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	60468.202	47654.135	12814.067
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	62860.350	49539.353	13320.997
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	64955.695	51190.665	13765.030
98	A310-200	132000	291009	93.70%	2	2	30921	99619.701	78508.878	21110.823
99	A310-300	150000	330693	94.50%	2	2	35437.5	114170.730	89976.338	24194.392
100	A318-100	68000	149914	90.80%	2	2	15436	49730.918	39192.233	10538.685
101	A319-100	64000	141096	92.70%	2	2	14832	47784.981	37658.668	10126.313
102	A319-Neo	64000	141096	90.80%	2	2	14528	46805.569	36886.807	9918.762
103	A320-200	78000	171961	95.10%	2	2	18544.5	59745.724	47084.761	12660.964
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	60257.177	47487.829	12769.348
105	A321-100	89000	196211	95.00%	2	2	21137.5	68099.720	53668.426	14431.293
106	A321-200	93500	206132	95.30%	2	2	22276.375	71768.889	56560.047	15208.842
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	74221.043	58492.554	15728.488
108	A330-200	242000	535519	92.70%	2	4	28041.75	90343.480	71198.419	19145.061
109	A330-200F	233000	513677	94.70%	2	4	27581.375	88860.267	70029.520	18830.747
110	A330-300	242000	535519	93.80%	2	4	28374.5	91415.517	72043.276	19372.241
111	A330-800	242000	533519	92.80%	2	4	28072	90440.938	71275.224	19165.714
112	A330-900	242000	533519	93.90%	2	4	28404.75	91512.975	72120.082	19392.893
113	A340-200	275000	606271	93.50%	2	4	32140.625	103549.026	81605.524	21943.503
114	A340-300	276500	609578	93.80%	2	4	32419.625	104447.894	82313.909	22133.986
115	A340-500	380000	837756	93.50%	3	4	29608.33333	95390.618	75175.997	20214.621
116	A340-600	380000	837756	92.30%	3	4	29228.33333	94166.354	74211.172	19955.182
117	A350-900	280000	617295	93.10%	2	4	32585	104980.691	82733.798	22246.893
118	A350-1000	308000	679024	94.20%	2	6	24178	77895.447	61388.301	16507.147
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	72788.036	57363.222	15424.814

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	29154.332	22976.116	6178.215
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	32277.737	25437.628	6840.109
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	33839.439	26668.384	7171.056
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	32971.742	25984.563	6987.178
124	Avro RJ85	44000	97000	95.00%	2	2	10450	33667.277	26532.705	7134.572
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	35228.214	27762.858	7465.357
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13483.793	10626.387	2857.406
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14316.769	11282.843	3033.926
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	14958.983	11788.963	3170.020
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	14958.983	11788.963	3170.020
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	16728.927	13183.831	3545.096
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	16728.927	13183.831	3545.096
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4685.488	3692.567	992.921
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5206.098	4102.852	1103.246
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	5969.659	4704.604	1265.055
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6351.439	5005.479	1345.960
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7062.939	5566.203	1496.737
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7462.073	5880.755	1581.319
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7462.073	5880.755	1581.319
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16468.655	12978.714	3489.941
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18394.576	14496.505	3898.071
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	25336.156	19967.067	5369.090
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	31861.487	25109.587	6751.900
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9641.693	7598.482	2043.211
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	11783.547	9286.447	2497.100
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12395.679	9768.860	2626.820
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8725.420	6876.380	1849.040
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	11982.490	9443.231	2539.259
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10704.664	8436.194	2268.470
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	9891.293	7795.188	2096.105
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4338.488	3419.101	919.387
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15271.171	12034.994	3236.177
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	22386.444	17642.440	4744.004
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14538.142	11457.304	3080.838
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	38487.819	30331.706	8156.113
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	15617.026	12307.557	3309.469
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	25336.156	19967.067	5369.090
157	F-50	18990	41866	95.00%	2	2	4510.125	14530.491	11451.274	3079.216
158	F-70	39915	87998	95.00%	2	2	9479.8125	30541.576	24069.385	6472.192
159	F-100	43090	94997	95.00%	2	2	10233.875	32970.977	25983.960	6987.016
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10680.944	8417.501	2263.443
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	13709.468	10804.238	2905.230
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3714.113	2927.040	787.073
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3678.915	2899.301	779.614
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4338.488	3419.101	919.387
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4294.873	3384.729	910.144
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4813.655	3793.574	1020.082
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5771.643	4548.550	1223.093
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5841.273	4603.424	1237.848
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	4893.998	3856.890	1037.107
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4112.764	3241.211	871.553
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3609.285	2844.427	764.859
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	3000.213	2364.426	635.788
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5240.618	4130.057	1110.561
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5657.633	4458.700	1198.932
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5518.373	4348.952	1169.421
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	6941.580	5470.561	1471.019
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7636.351	6018.100	1618.251
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7636.351	6018.100	1618.251
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	7982.970	6291.266	1691.704
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	7011.210	5525.436	1485.775
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	7011.210	5525.436	1485.775

p. Kemiringan 16° (g = 28,7 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14163.354	11944.931	2218.423
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14163.354	11944.931	2218.423
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17361.531	14642.173	2719.358
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17361.531	14642.173	2719.358
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	30668.135	25864.547	4803.587
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	33812.399	28516.322	5296.077
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	36517.600	30797.804	5719.796
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	36517.600	30797.804	5719.796
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	38546.687	32509.072	6037.615
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	40913.458	34505.133	6408.325
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	47337.657	39923.102	7414.555
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	109891.230	92678.833	17212.397
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	120034.428	101233.289	18801.139
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	72697.143	61310.501	11386.642
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	95847.835	80835.072	15012.763
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	95847.835	80835.072	15012.763
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	104052.682	87754.783	16297.898
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	108885.736	91830.830	17054.905
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	104052.682	87754.783	16297.898
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	104052.682	87754.783	16297.898
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	104052.682	87754.783	16297.898
22	MD-81	63504	140000	92.40%	2	2	14669.424	47032.994	39666.159	7366.835
23	MD-82	67812	149500	92.40%	2	2	15664.572	50223.630	42357.041	7866.588
24	MD-83	72575	160000	92.40%	2	2	16764.825	53751.252	45332.128	8419.124
25	MD-87	63503	140000	92.40%	2	2	14669.193	47032.253	39665.534	7366.719
26	MD-88	67812	149500	92.40%	2	2	15664.572	50223.630	42357.041	7866.588
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	27360.542	23075.027	4285.515
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	29465.556	24850.330	4615.226
29	B707-120B	117000	257340	97.30%	2	4	14230.125	45624.517	38478.293	7146.224
30	B707-320	141700	312000	96.00%	2	4	17004	54518.093	45978.858	8539.235
31	B707-420	141700	312000	96.00%	2	4	17004	54518.093	45978.858	8539.235
32	B707-320B	148500	327000	96.00%	2	4	17820	57134.346	48185.324	8949.022
33	B707-320C	151500	333600	96.00%	2	4	18180	58288.575	49158.765	9129.811
34	B717-200	54884	121000	96.00%	2	2	13172.16	42232.477	35617.553	6614.924
35	B720	104000	229300	95.00%	2	4	12350	39596.474	33394.430	6202.044
36	B720B	106200	234300	95.00%	2	4	12611.25	40434.092	34100.851	6333.241
37	B727-100	76700	169000	95.40%	2	2	18292.95	58650.715	49464.182	9186.533
38	B727-100C	76700	169000	95.40%	2	2	18292.95	58650.715	49464.182	9186.533
39	B727-200	95100	209500	93.00%	2	2	22110.75	70891.316	59787.522	11103.793
40	B737-100	50349	110000	92.30%	2	2	11618.03175	37249.643	31415.186	5834.457
41	B737-200	52390	115000	93.70%	2	2	12272.3575	39347.538	33184.485	6163.053
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	39347.538	33184.485	6163.053
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	42754.886	36058.136	6696.750
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	43639.791	36804.438	6835.354
45	B737-300	63276	139500	90.80%	2	2	14363.652	46052.630	38839.350	7213.280
46	B737-400	68039	150000	93.80%	2	2	15955.1455	51155.264	43142.753	8012.511
47	B737-500	61689	136000	92.30%	2	2	14234.73675	45639.303	38490.763	7148.540
48	B737-600	65544	144500	91.60%	2	2	15009.576	48123.586	40585.930	7537.656
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	51620.667	43535.259	8085.408
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	59281.674	49996.313	9285.361
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	59281.674	49996.313	9285.361
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	64626.122	54503.654	10122.468
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	57011.058	48081.347	8929.712
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	59280.924	49995.681	9285.243
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	60105.784	50691.342	9414.442
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	61531.955	51894.130	9637.825
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	66540.641	56118.299	10422.342
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	126353.111	106562.270	19790.842
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	123826.792	104431.651	19395.141
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	101089.919	85256.082	15833.837

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	140056.497	118119.277	21937.220
62	B747-200C	362800	800000	94.10%	2	4	42674.35	136822.171	115391.547	21430.623
63	B747-200F	356000	785000	94.00%	2	4	41830	134115.022	113108.423	21006.599
64	B747-300	340100	750000	92.50%	2	4	39324.0625	126080.505	106332.362	19748.143
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	100871.818	85072.142	15799.676
66	B747-300	377800	833000	92.50%	2	4	43683.125	140056.497	118119.277	21937.220
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	140056.497	118119.277	21937.220
68	B747-SP	315600	698000	87.80%	2	4	34637.1	111053.202	93658.804	17394.398
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	74203.733	62581.112	11622.621
70	B747-8	447696	987000	94.70%	4	4	26498.007	84957.705	71650.676	13307.029
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	83570.319	70480.598	13089.721
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	42270.759	35649.839	6620.921
73	B757-300	122470	270000	92.70%	2	4	14191.21125	45499.752	38373.070	7126.682
74	B767-200	142882	315000	92.60%	2	4	16538.5915	53025.904	44720.392	8305.512
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	65200.105	54987.733	10212.372
76	B767-300	158758	350000	92.70%	2	4	18396.08325	58981.380	49743.054	9238.325
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	69129.609	58301.754	10827.855
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	69129.609	58301.754	10827.855
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	76896.129	64851.795	12044.334
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	71058.919	59928.874	11130.045
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	71058.919	59928.874	11130.045
82	B777-300	299370	660000	92.30%	2	6	23026.5425	73827.522	62263.828	11563.695
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	85220.840	71872.596	13348.244
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	86785.837	73192.466	13593.371
85	B777-F	347815	766800	91.70%	2	6	26578.86292	85216.945	71869.311	13347.634
86	B777-9	351535	775000	94.20%	2	6	27595.4975	88476.471	74618.293	13858.177
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	88476.471	74618.293	13858.177
88	B787-8	227930	502500	91.20%	2	4	25984.02	83309.764	70260.854	13048.910
89	B787-9	254011	560000	92.30%	2	4	29306.51913	93962.335	79244.900	14717.435
90	B787-10	254011	560000	93.20%	2	4	29592.2815	94878.544	80017.602	14860.942
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	49964.499	42138.498	7826.000
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	51788.020	43676.400	8111.621
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	54705.655	46137.042	8568.613
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	60176.221	50750.746	9425.475
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	60176.221	50750.746	9425.475
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	62556.819	52758.468	9798.351
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	64642.046	54517.084	10124.962
98	A310-200	132000	291009	93.70%	2	2	30921	99138.671	83610.460	15528.211
99	A310-300	150000	330693	94.50%	2	2	35437.5	113619.438	95823.087	17796.351
100	A318-100	68000	149914	90.80%	2	2	15436	49490.784	41738.982	7751.802
101	A319-100	64000	141096	92.70%	2	2	14832	47554.244	40105.764	7448.479
102	A319-Neo	64000	141096	90.80%	2	2	14528	46579.561	39283.748	7295.813
103	A320-200	78000	171961	95.10%	2	2	18544.5	59457.232	50144.374	9312.859
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	59966.215	50573.634	9392.581
105	A321-100	89000	196211	95.00%	2	2	21137.5	67770.889	57155.852	10615.037
106	A321-200	93500	206132	95.30%	2	2	22276.375	71422.341	60235.373	11186.968
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	73862.654	62293.457	11569.198
108	A330-200	242000	535519	92.70%	2	4	28041.75	89907.242	75824.961	14082.281
109	A330-200F	233000	513677	94.70%	2	4	27581.375	88431.191	74580.106	13851.085
110	A330-300	242000	535519	93.80%	2	4	28374.5	90974.102	76724.718	14249.384
111	A330-800	242000	533519	92.80%	2	4	28072	90004.229	75906.757	14097.472
112	A330-900	242000	533519	93.90%	2	4	28404.75	91071.090	76806.514	14264.576
113	A340-200	275000	606271	93.50%	2	4	32140.625	103049.023	86908.329	16140.694
114	A340-300	276500	609578	93.80%	2	4	32419.625	103943.551	87662.746	16280.805
115	A340-500	380000	837756	93.50%	3	4	29608.33333	94930.009	80061.006	14869.003
116	A340-600	380000	837756	92.30%	3	4	29228.33333	93711.656	79033.485	14678.171
117	A350-900	280000	617295	93.10%	2	4	32585	104473.775	88109.920	16363.855
118	A350-1000	308000	679024	94.20%	2	6	24178	77519.316	65377.371	12141.945
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	72436.567	61090.739	11345.828

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	29013.555	24469.127	4544.428
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	32121.878	27090.589	5031.289
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	33676.040	28401.321	5274.719
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	32812.532	27673.065	5139.467
124	Avro RJ85	44000	97000	95.00%	2	2	10450	33504.709	28256.826	5247.883
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	35058.109	29566.915	5491.194
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13418.684	11316.900	2101.785
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14247.638	12016.013	2231.625
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	14886.751	12555.021	2331.730
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	14886.751	12555.021	2331.730
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	16648.149	14040.529	2607.620
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	16648.149	14040.529	2607.620
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4662.863	3932.513	730.350
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5180.959	4369.459	811.500
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	5940.833	5010.313	930.520
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6320.770	5330.740	990.030
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	7028.835	5927.900	1100.935
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7426.042	6262.892	1163.150
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7426.042	6262.892	1163.150
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16389.133	13822.083	2567.050
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18305.755	15438.502	2867.253
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	25213.817	21264.546	3949.271
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	31707.638	26741.232	4966.406
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9595.137	8092.239	1502.898
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	11726.648	9889.889	1836.759
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12335.825	10403.649	1932.175
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8683.288	7323.214	1360.074
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	11924.631	10056.861	1867.769
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10652.975	8984.386	1668.588
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	9843.531	8301.727	1541.804
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4317.539	3641.277	676.261
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15197.431	12817.039	2380.392
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	22278.347	18788.862	3489.485
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14467.943	12201.811	2266.131
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	38301.974	32302.689	5999.285
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	15541.616	13107.314	2434.302
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	25213.817	21264.546	3949.271
157	F-50	18990	41866	95.00%	2	2	4510.125	14460.328	12195.389	2264.939
158	F-70	39915	87998	95.00%	2	2	9479.8125	30394.101	25633.436	4760.665
159	F-100	43090	94997	95.00%	2	2	10233.875	32811.771	27672.423	5139.348
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10629.369	8964.478	1664.891
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	13643.270	11506.308	2136.962
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3696.179	3117.242	578.937
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3661.151	3087.700	573.451
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4317.539	3641.277	676.261
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4274.135	3604.672	669.463
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4790.412	4040.084	750.328
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5743.773	4844.119	899.654
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5813.067	4902.559	910.508
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	4870.366	4107.515	762.851
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4092.905	3451.828	641.077
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3591.857	3029.260	562.597
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	2985.726	2518.068	467.658
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5215.313	4398.432	816.881
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5630.314	4748.431	881.883
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5491.726	4631.551	860.176
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	6908.062	5826.044	1082.018
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7599.477	6409.162	1190.315
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7599.477	6409.162	1190.315
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	7944.423	6700.079	1244.345
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	6977.356	5884.484	1092.872
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	6977.356	5884.484	1092.872

q. Kemiringan 17° (g = 30,6 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14090.318	12670.125	1420.193
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14090.318	12670.125	1420.193
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17272.003	15531.121	1740.882
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17272.003	15531.121	1740.882
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	30509.988	27434.822	3075.166
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	33638.039	30247.590	3390.449
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	36329.290	32667.584	3661.706
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	36329.290	32667.584	3661.706
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	38347.913	34482.746	3865.167
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	40702.479	36599.991	4102.489
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	47093.551	42346.893	4746.659
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	109324.553	98305.501	11019.053
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	119415.446	107379.311	12036.135
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	72322.266	65032.752	7289.514
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	95353.576	85742.688	9610.888
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	95353.576	85742.688	9610.888
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	103516.113	93082.505	10433.608
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	108324.245	97406.015	10918.230
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	103516.113	93082.505	10433.608
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	103516.113	93082.505	10433.608
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	103516.113	93082.505	10433.608
22	MD-81	63504	140000	92.40%	2	2	14669.424	46790.459	42074.349	4716.109
23	MD-82	67812	149500	92.40%	2	2	15664.572	49964.641	44928.599	5036.042
24	MD-83	72575	160000	92.40%	2	2	16764.825	53474.073	48084.308	5389.765
25	MD-87	63503	140000	92.40%	2	2	14669.193	46789.722	42073.687	4716.035
26	MD-88	67812	149500	92.40%	2	2	15664.572	49964.641	44928.599	5036.042
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	27219.452	24475.946	2743.506
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	29313.611	26359.030	2954.581
29	B707-120B	117000	257340	97.30%	2	4	14230.125	45389.245	40814.367	4574.878
30	B707-320	141700	312000	96.00%	2	4	17004	54236.960	48770.302	5466.658
31	B707-420	141700	312000	96.00%	2	4	17004	54236.960	48770.302	5466.658
32	B707-320B	148500	327000	96.00%	2	4	17820	56839.721	51110.726	5728.996
33	B707-320C	151500	333600	96.00%	2	4	18180	57987.998	52143.266	5844.733
34	B717-200	54884	121000	96.00%	2	2	13172.16	42014.697	37779.947	4234.750
35	B720	104000	229300	95.00%	2	4	12350	39392.287	35421.855	3970.432
36	B720B	106200	234300	95.00%	2	4	12611.25	40225.586	36171.164	4054.422
37	B727-100	76700	169000	95.40%	2	2	18292.95	58348.270	52467.225	5881.045
38	B727-100C	76700	169000	95.40%	2	2	18292.95	58348.270	52467.225	5881.045
39	B727-200	95100	209500	93.00%	2	2	22110.75	70525.750	63417.311	7108.439
40	B737-100	50349	110000	92.30%	2	2	11618.03175	37057.558	33322.449	3735.110
41	B737-200	52390	115000	93.70%	2	2	12272.3575	39144.634	35199.164	3945.470
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	39144.634	35199.164	3945.470
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	42534.412	38247.279	4287.133
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	43414.754	39038.889	4375.865
45	B737-300	63276	139500	90.80%	2	2	14363.652	45815.150	41197.344	4617.806
46	B737-400	68039	150000	93.80%	2	2	15955.1455	50891.472	45762.013	5129.459
47	B737-500	61689	136000	92.30%	2	2	14234.73675	45403.955	40827.594	4576.361
48	B737-600	65544	144500	91.60%	2	2	15009.576	47875.427	43049.962	4825.466
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	51354.474	46178.348	5176.126
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	58975.976	53031.663	5944.313
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	58975.976	53031.663	5944.313
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	64292.864	57812.650	6480.214
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	56717.069	51000.436	5716.633
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	58975.230	53030.992	5944.238
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	59795.837	53768.888	6026.949
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	61214.653	55044.698	6169.954
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	66197.511	59525.324	6672.187
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	125701.546	113031.822	12669.724
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	123188.254	110771.850	12416.404
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	100568.629	90432.104	10136.525

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	139334.268	125290.472	14043.795
62	B747-200C	362800	800000	94.10%	2	4	42674.35	136116.620	122397.138	13719.482
63	B747-200F	356000	785000	94.00%	2	4	41830	133423.431	119975.401	13448.030
64	B747-300	340100	750000	92.50%	2	4	39324.0625	125430.345	112787.956	12642.390
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	100351.652	90236.997	10114.655
66	B747-300	377800	833000	92.50%	2	4	43683.125	139334.268	125290.472	14043.795
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	139334.268	125290.472	14043.795
68	B747-SP	315600	698000	87.80%	2	4	34637.1	110480.534	99344.967	11135.566
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	73821.087	66380.503	7440.583
70	B747-8	447696	987000	94.70%	4	4	26498.007	84519.603	76000.694	8518.909
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	83139.372	74759.579	8379.793
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	42052.782	37814.193	4238.589
73	B757-300	122470	270000	92.70%	2	4	14191.21125	45265.123	40702.756	4562.367
74	B767-200	142882	315000	92.60%	2	4	16538.5915	52752.465	47435.433	5317.032
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	64863.887	58326.119	6537.768
76	B767-300	158758	350000	92.70%	2	4	18396.08325	58677.230	52763.028	5914.202
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	68773.128	61841.339	6931.789
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	68773.128	61841.339	6931.789
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	76499.598	68789.042	7710.556
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	70692.490	63567.244	7125.245
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	70692.490	63567.244	7125.245
82	B777-300	299370	660000	92.30%	2	6	23026.5425	73446.816	66043.956	7402.860
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	84781.382	76236.087	8545.295
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	86338.309	77636.088	8702.221
85	B777-F	347815	766800	91.70%	2	6	26578.86292	84777.506	76232.602	8544.904
86	B777-9	351535	775000	94.20%	2	6	27595.4975	88020.224	79148.479	8871.744
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	88020.224	79148.479	8871.744
88	B787-8	227930	502500	91.20%	2	4	25984.02	82880.160	74526.494	8353.667
89	B787-9	254011	560000	92.30%	2	4	29306.51913	93477.799	84055.974	9421.825
90	B787-10	254011	560000	93.20%	2	4	29592.2815	94389.284	84875.588	9513.695
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	49706.847	44696.788	5010.058
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	51520.965	46328.058	5192.907
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	54423.555	48938.090	5485.465
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	59865.910	53831.899	6034.012
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	59865.910	53831.899	6034.012
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	62234.232	55961.512	6272.720
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	64308.706	57826.896	6481.810
98	A310-200	132000	291009	93.70%	2	2	30921	98627.442	88686.574	9940.868
99	A310-300	150000	330693	94.50%	2	2	35437.5	113033.537	101640.648	11392.889
100	A318-100	68000	149914	90.80%	2	2	15436	49235.575	44273.017	4962.558
101	A319-100	64000	141096	92.70%	2	2	14832	47309.021	42540.644	4768.376
102	A319-Neo	64000	141096	90.80%	2	2	14528	46339.364	41668.722	4670.642
103	A320-200	78000	171961	95.10%	2	2	18544.5	59150.629	53188.712	5961.917
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	59656.988	53644.034	6012.954
105	A321-100	89000	196211	95.00%	2	2	21137.5	67421.415	60625.868	6795.547
106	A321-200	93500	206132	95.30%	2	2	22276.375	71054.037	63892.351	7161.687
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	73481.767	66075.384	7406.383
108	A330-200	242000	535519	92.70%	2	4	28041.75	89443.617	80428.406	9015.211
109	A330-200F	233000	513677	94.70%	2	4	27581.375	87975.178	79107.974	8867.204
110	A330-300	242000	535519	93.80%	2	4	28374.5	90504.976	81382.788	9122.188
111	A330-800	242000	533519	92.80%	2	4	28072	89540.104	80515.168	9024.936
112	A330-900	242000	533519	93.90%	2	4	28404.75	90601.463	81469.550	9131.913
113	A340-200	275000	606271	93.50%	2	4	32140.625	102517.630	92184.661	10332.969
114	A340-300	276500	609578	93.80%	2	4	32419.625	103407.545	92984.880	10422.665
115	A340-500	380000	837756	93.50%	3	4	29608.33333	94440.483	84921.628	9518.856
116	A340-600	380000	837756	92.30%	3	4	29228.33333	93228.413	83831.724	9396.689
117	A350-900	280000	617295	93.10%	2	4	32585	103935.035	93459.203	10475.832
118	A350-1000	308000	679024	94.20%	2	6	24178	77119.572	69346.528	7773.045
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	72063.033	64799.647	7263.385

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	28863.941	25954.683	2909.258
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	31956.235	28735.299	3220.937
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	33502.383	30125.607	3376.776
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	32643.328	29353.138	3290.190
124	Avro RJ85	44000	97000	95.00%	2	2	10450	33331.935	29972.339	3359.596
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	34877.325	31361.966	3515.359
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13349.488	12003.965	1345.523
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14174.167	12745.523	1428.644
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	14809.985	13317.255	1492.730
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	14809.985	13317.255	1492.730
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	16562.300	14892.950	1669.349
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	16562.300	14892.950	1669.349
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4638.818	4171.262	467.556
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5154.243	4634.736	519.507
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	5910.198	5314.497	595.701
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6288.176	5654.377	633.799
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	6992.589	6287.791	704.798
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7387.748	6643.121	744.627
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7387.748	6643.121	744.627
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16304.619	14661.242	1643.377
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18211.357	16375.796	1835.561
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	25083.796	22555.548	2528.249
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	31544.132	28364.732	3179.400
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9545.657	8583.530	962.127
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	11666.177	10490.319	1175.859
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12272.213	11035.270	1236.942
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8638.511	7767.817	870.694
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	11863.139	10667.428	1195.711
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10598.040	9529.841	1068.199
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	9792.771	8805.737	987.034
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4295.274	3862.345	432.930
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15119.063	13595.181	1523.882
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	22163.464	19929.562	2233.902
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14393.336	12942.601	1450.735
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	38104.462	34263.833	3840.629
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	15461.473	13903.078	1558.395
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	25083.796	22555.548	2528.249
157	F-50	18990	41866	95.00%	2	2	4510.125	14385.760	12935.789	1449.971
158	F-70	39915	87998	95.00%	2	2	9479.8125	30237.368	27189.680	3047.688
159	F-100	43090	94997	95.00%	2	2	10233.875	32642.570	29352.457	3290.114
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10574.556	9508.725	1065.832
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	13572.916	12204.873	1368.043
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3677.119	3306.494	370.625
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3642.271	3275.159	367.112
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4295.274	3862.345	432.930
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4252.094	3823.517	428.578
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4765.709	4285.363	480.346
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5714.154	5138.213	575.942
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5783.091	5200.201	582.890
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	4845.251	4356.888	488.363
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4071.799	3661.394	410.405
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3573.335	3213.171	360.164
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	2970.330	2670.944	299.386
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5188.419	4665.467	522.952
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5601.280	5036.715	564.565
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5463.407	4912.739	550.668
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	6872.439	6179.751	692.688
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7560.289	6798.271	762.018
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7560.289	6798.271	762.018
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	7903.456	7106.850	796.606
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	6941.376	6241.740	699.636
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	6941.376	6241.740	699.636

r. Kemiringan 18° (g = 32,5 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	14012.990	13391.460	621.530
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	14012.990	13391.460	621.530
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17177.213	16415.338	761.875
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17177.213	16415.338	761.875
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	30342.548	28996.740	1345.808
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	33453.432	31969.644	1483.788
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	36129.913	34527.413	1602.500
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	36129.913	34527.413	1602.500
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	38137.458	36445.916	1691.543
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	40479.103	38683.699	1795.403
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	46835.100	44757.784	2077.316
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	108724.576	103902.224	4822.352
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	118760.089	113492.624	5267.465
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	71925.358	68735.193	3190.165
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	94830.272	90624.186	4206.086
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	94830.272	90624.186	4206.086
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	102948.012	98381.873	4566.139
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	107729.757	102951.529	4778.228
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	102948.012	98381.873	4566.139
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	102948.012	98381.873	4566.139
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	102948.012	98381.873	4566.139
22	MD-81	63504	140000	92.40%	2	2	14669.424	46533.671	44469.724	2063.947
23	MD-82	67812	149500	92.40%	2	2	15664.572	49690.433	47486.472	2203.961
24	MD-83	72575	160000	92.40%	2	2	16764.825	53180.605	50821.841	2358.764
25	MD-87	63503	140000	92.40%	2	2	14669.193	46532.938	44469.024	2063.914
26	MD-88	67812	149500	92.40%	2	2	15664.572	49690.433	47486.472	2203.961
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	27070.070	25869.409	1200.661
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	29152.736	27859.701	1293.036
29	B707-120B	117000	257340	97.30%	2	4	14230.125	45140.147	43138.008	2002.139
30	B707-320	141700	312000	96.00%	2	4	17004	53939.305	51546.890	2392.415
31	B707-420	141700	312000	96.00%	2	4	17004	53939.305	51546.890	2392.415
32	B707-320B	148500	327000	96.00%	2	4	17820	56527.783	54020.559	2507.224
33	B707-320C	151500	333600	96.00%	2	4	18180	57669.758	55111.883	2557.875
34	B717-200	54884	121000	96.00%	2	2	13172.16	41784.119	39930.833	1853.286
35	B720	104000	229300	95.00%	2	4	12350	39176.101	37438.490	1737.610
36	B720B	106200	234300	95.00%	2	4	12611.25	40004.826	38230.458	1774.367
37	B727-100	76700	169000	95.40%	2	2	18292.95	58028.053	55454.286	2573.767
38	B727-100C	76700	169000	95.40%	2	2	18292.95	58028.053	55454.286	2573.767
39	B727-200	95100	209500	93.00%	2	2	22110.75	70138.702	67027.782	3110.920
40	B737-100	50349	110000	92.30%	2	2	11618.03175	36854.185	35219.560	1634.624
41	B737-200	52390	115000	93.70%	2	2	12272.3575	38929.807	37203.121	1726.686
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	38929.807	37203.121	1726.686
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	42300.982	40424.771	1876.211
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	43176.492	41261.449	1915.043
45	B737-300	63276	139500	90.80%	2	2	14363.652	45563.715	43542.789	2020.925
46	B737-400	68039	150000	93.80%	2	2	15955.1455	50612.177	48367.333	2244.844
47	B737-500	61689	136000	92.30%	2	2	14234.73675	45154.776	43151.988	2002.787
48	B737-600	65544	144500	91.60%	2	2	15009.576	47612.685	45500.880	2111.805
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	51072.639	48807.372	2265.267
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	58652.314	56050.859	2601.455
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	58652.314	56050.859	2601.455
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	63940.022	61104.037	2835.985
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	56405.804	53903.990	2501.814
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	58651.571	56050.149	2601.422
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	59467.675	56830.055	2637.619
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	60878.704	58178.500	2700.204
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	65834.216	62914.216	2920.000
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	125011.691	119466.943	5544.748
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	122512.192	117078.307	5433.886
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	100016.704	95580.580	4436.124

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	138569.596	132423.503	6146.093
62	B747-200C	362800	800000	94.10%	2	4	42674.35	135369.606	129365.445	6004.161
63	B747-200F	356000	785000	94.00%	2	4	41830	132691.198	126805.834	5885.363
64	B747-300	340100	750000	92.50%	2	4	39324.0625	124741.978	119209.193	5532.785
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	99800.918	95374.365	4426.553
66	B747-300	377800	833000	92.50%	2	4	43683.125	138569.596	132423.503	6146.093
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	138569.596	132423.503	6146.093
68	B747-SP	315600	698000	87.80%	2	4	34637.1	109874.212	105000.869	4873.343
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	73415.954	70159.675	3256.279
70	B747-8	447696	987000	94.70%	4	4	26498.007	84055.756	80327.561	3728.195
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	82683.099	79015.787	3667.313
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	41821.994	39967.028	1854.966
73	B757-300	122470	270000	92.70%	2	4	14191.21125	45016.706	43020.043	1996.664
74	B767-200	142882	315000	92.60%	2	4	16538.5915	52462.958	50136.024	2326.933
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	64507.911	61646.738	2861.173
76	B767-300	158758	350000	92.70%	2	4	18396.08325	58355.207	55766.930	2588.277
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	68395.699	65362.087	3033.612
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	68395.699	65362.087	3033.612
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	76079.766	72705.336	3374.429
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	70304.526	67186.251	3118.275
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	70304.526	67186.251	3118.275
82	B777-300	299370	660000	92.30%	2	6	23026.5425	73043.737	69803.967	3239.770
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	84316.098	80576.356	3739.742
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	85864.480	82056.061	3808.419
85	B777-F	347815	766800	91.70%	2	6	26578.86292	84312.244	80572.672	3739.571
86	B777-9	351535	775000	94.20%	2	6	27595.4975	87537.165	83654.556	3882.609
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	87537.165	83654.556	3882.609
88	B787-8	227930	502500	91.20%	2	4	25984.02	82425.310	78769.432	3655.879
89	B787-9	254011	560000	92.30%	2	4	29306.51913	92964.789	88841.444	4123.345
90	B787-10	254011	560000	93.20%	2	4	29592.2815	93871.271	89707.720	4163.551
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	49434.053	47241.464	2192.590
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	51238.216	48965.605	2272.611
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	54124.876	51724.230	2400.646
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	59537.364	56896.653	2640.710
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	59537.364	56896.653	2640.710
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	61892.688	59147.510	2745.178
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	63955.777	61119.093	2836.684
98	A310-200	132000	291009	93.70%	2	2	30921	98086.171	93735.673	4350.498
99	A310-300	150000	330693	94.50%	2	2	35437.5	112413.204	107427.247	4985.957
100	A318-100	68000	149914	90.80%	2	2	15436	48965.368	46793.566	2171.802
101	A319-100	64000	141096	92.70%	2	2	14832	47049.387	44962.566	2086.821
102	A319-Neo	64000	141096	90.80%	2	2	14528	46085.052	44041.003	2044.049
103	A320-200	78000	171961	95.10%	2	2	18544.5	58826.008	56216.849	2609.159
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	59329.588	56698.093	2631.495
105	A321-100	89000	196211	95.00%	2	2	21137.5	67051.403	64077.416	2973.987
106	A321-200	93500	206132	95.30%	2	2	22276.375	70664.090	67529.867	3134.223
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	73078.496	69837.184	3241.312
108	A330-200	242000	535519	92.70%	2	4	28041.75	88952.747	85007.351	3945.395
109	A330-200F	233000	513677	94.70%	2	4	27581.375	87492.366	83611.744	3880.622
110	A330-300	242000	535519	93.80%	2	4	28374.5	90008.281	86016.069	3992.212
111	A330-800	242000	533519	92.80%	2	4	28072	89048.704	85099.053	3949.652
112	A330-900	242000	533519	93.90%	2	4	28404.75	90104.239	86107.770	3996.468
113	A340-200	275000	606271	93.50%	2	4	32140.625	101955.009	97432.913	4522.096
114	A340-300	276500	609578	93.80%	2	4	32419.625	102840.040	98278.690	4561.350
115	A340-500	380000	837756	93.50%	3	4	29608.33333	93922.190	89756.381	4165.809
116	A340-600	380000	837756	92.30%	3	4	29228.33333	92716.772	88604.427	4112.344
117	A350-900	280000	617295	93.10%	2	4	32585	103364.635	98780.017	4584.618
118	A350-1000	308000	679024	94.20%	2	6	24178	76696.337	73294.560	3401.777
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	71667.548	68488.817	3178.731

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	28705.534	27432.334	1273.201
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	31780.858	30371.255	1409.603
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	33318.520	31840.716	1477.804
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	32464.180	31024.269	1439.911
124	Avro RJ85	44000	97000	95.00%	2	2	10450	33149.008	31678.723	1470.286
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	34685.917	33147.463	1538.453
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13276.226	12687.374	588.852
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14096.379	13471.150	625.228
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	14728.707	14075.432	653.275
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	14728.707	14075.432	653.275
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	16471.405	15740.835	730.570
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	16471.405	15740.835	730.570
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4613.360	4408.740	204.620
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5125.956	4898.600	227.356
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	5877.763	5617.061	260.701
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6253.666	5976.292	277.374
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	6954.214	6645.767	308.446
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7347.203	7021.327	325.877
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7347.203	7021.327	325.877
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16215.139	15495.935	719.204
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18111.413	17308.102	803.311
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	24946.136	23839.679	1106.457
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	31371.016	29979.591	1391.425
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9493.270	9072.207	421.063
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	11602.153	11087.553	514.600
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12204.862	11663.530	541.332
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8591.102	8210.054	381.048
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	11798.033	11274.745	523.288
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10539.878	10072.394	467.484
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	9739.028	9307.065	431.963
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4271.702	4082.235	189.466
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	15036.089	14369.181	666.908
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	22041.830	21064.191	977.640
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14314.344	13679.448	634.896
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	37895.344	36214.540	1680.804
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	15376.620	14694.607	682.012
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	24946.136	23839.679	1106.457
157	F-50	18990	41866	95.00%	2	2	4510.125	14306.811	13672.249	634.562
158	F-70	39915	87998	95.00%	2	2	9479.8125	30071.424	28737.641	1333.783
159	F-100	43090	94997	95.00%	2	2	10233.875	32463.427	31023.549	1439.877
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10516.523	10050.075	466.448
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	13498.427	12899.720	598.707
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3656.938	3494.739	162.199
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3622.283	3461.620	160.662
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4271.702	4082.235	189.466
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4228.759	4041.197	187.562
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4739.555	4529.337	210.217
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5682.795	5430.741	252.054
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5751.353	5496.258	255.095
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	4818.660	4604.934	213.726
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4049.453	3869.844	179.609
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3553.724	3396.103	157.621
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	2954.029	2823.006	131.022
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5159.944	4931.081	228.863
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5570.540	5323.465	247.075
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5433.424	5192.431	240.993
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	6834.723	6531.577	303.146
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7518.798	7185.310	333.488
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7518.798	7185.310	333.488
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	7860.082	7511.457	348.625
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	6903.281	6597.094	306.187
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	6903.281	6597.094	306.187

s. Kemiringan 19° (g = 34,4 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	13931.393	14108.716	-177.323
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	13931.393	14108.716	-177.323
3	ATR 72-500	22800	50265	95.00%	2	2	5415	17077.192	17294.555	-217.363
4	ATR 72-600	22800	50265	95.00%	2	2	5415	17077.192	17294.555	-217.363
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	30165.866	30549.825	-383.959
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	33258.635	33681.960	-423.325
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	35919.531	36376.725	-457.194
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	35919.531	36376.725	-457.194
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	37915.386	38397.984	-482.597
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	40243.395	40755.624	-512.229
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	46562.382	47155.041	-592.659
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	108091.480	109467.298	-1375.818
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	118068.557	119571.366	-1502.809
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	71506.541	72416.696	-910.155
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	94278.082	95478.079	-1199.997
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	94278.082	95478.079	-1199.997
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	102348.553	103651.273	-1302.720
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	107102.453	108465.683	-1363.229
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	102348.553	103651.273	-1302.720
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	102348.553	103651.273	-1302.720
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	102348.553	103651.273	-1302.720
22	MD-81	63504	140000	92.40%	2	2	14669.424	46262.708	46851.552	-588.844
23	MD-82	67812	149500	92.40%	2	2	15664.572	49401.089	50029.880	-628.791
24	MD-83	72575	160000	92.40%	2	2	16764.825	52870.938	53543.894	-672.956
25	MD-87	63503	140000	92.40%	2	2	14669.193	46261.980	46850.815	-588.835
26	MD-88	67812	149500	92.40%	2	2	15664.572	49401.089	50029.880	-628.791
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	26912.443	27254.992	-342.549
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	28982.982	29351.885	-368.903
29	B707-120B	117000	257340	97.30%	2	4	14230.125	44877.298	45448.509	-571.211
30	B707-320	141700	312000	96.00%	2	4	17004	53625.220	54307.776	-682.557
31	B707-420	141700	312000	96.00%	2	4	17004	53625.220	54307.776	-682.557
32	B707-320B	148500	327000	96.00%	2	4	17820	56198.625	56913.936	-715.312
33	B707-320C	151500	333600	96.00%	2	4	18180	57333.951	58063.713	-729.762
34	B717-200	54884	121000	96.00%	2	2	13172.16	41540.813	42069.555	-528.743
35	B720	104000	229300	95.00%	2	4	12350	38947.981	39443.721	-495.741
36	B720B	106200	234300	95.00%	2	4	12611.25	39771.880	40278.108	-506.227
37	B727-100	76700	169000	95.40%	2	2	18292.95	57690.159	58424.455	-734.296
38	B727-100C	76700	169000	95.40%	2	2	18292.95	57690.159	58424.455	-734.296
39	B727-200	95100	209500	93.00%	2	2	22110.75	69730.289	70617.835	-887.546
40	B737-100	50349	110000	92.30%	2	2	11618.03175	36639.585	37105.944	-466.359
41	B737-200	52390	115000	93.70%	2	2	12272.3575	38703.121	39195.745	-492.624
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	38703.121	39195.745	-492.624
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	42054.666	42589.949	-535.283
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	42925.078	43471.440	-546.362
45	B737-300	63276	139500	90.80%	2	2	14363.652	45298.400	45874.971	-576.570
46	B737-400	68039	150000	93.80%	2	2	15955.1455	50317.466	50957.920	-640.455
47	B737-500	61689	136000	92.30%	2	2	14234.73675	44891.842	45463.238	-571.396
48	B737-600	65544	144500	91.60%	2	2	15009.576	47335.440	47937.938	-602.498
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	50775.246	51421.528	-646.281
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	58310.785	59052.981	-742.196
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	58310.785	59052.981	-742.196
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	63567.704	64376.811	-809.107
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	56077.356	56791.124	-713.768
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	58310.047	59052.233	-742.186
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	59121.398	59873.911	-752.513
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	60524.211	61294.580	-770.369
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	65450.868	66283.944	-833.077
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	124283.756	125865.674	-1581.918
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	121798.812	123349.100	-1550.289
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	99434.313	100699.941	-1265.627

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	137762.714	139516.195	-1753.482
62	B747-200C	362800	800000	94.10%	2	4	42674.35	134581.357	136294.346	-1712.988
63	B747-200F	356000	785000	94.00%	2	4	41830	131918.546	133597.641	-1679.095
64	B747-300	340100	750000	92.50%	2	4	39324.0625	124015.614	125594.119	-1578.505
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	99219.784	100482.681	-1262.897
66	B747-300	377800	833000	92.50%	2	4	43683.125	137762.714	139516.195	-1753.482
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	137762.714	139516.195	-1753.482
68	B747-SP	315600	698000	87.80%	2	4	34637.1	109234.422	110624.787	-1390.366
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	72988.457	73917.474	-929.017
70	B747-8	447696	987000	94.70%	4	4	26498.007	83566.305	84629.960	-1063.655
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	82201.641	83247.926	-1046.285
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	41578.468	42107.690	-529.222
73	B757-300	122470	270000	92.70%	2	4	14191.21125	44754.577	45324.225	-569.649
74	B767-200	142882	315000	92.60%	2	4	16538.5915	52157.469	52821.344	-663.875
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	64132.286	64948.579	-816.293
76	B767-300	158758	350000	92.70%	2	4	18396.08325	58015.409	58753.845	-738.436
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	67997.435	68862.925	-865.490
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	67997.435	68862.925	-865.490
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	75636.758	76599.483	-962.725
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	69895.148	70784.792	-889.645
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	69895.148	70784.792	-889.645
82	B777-300	299370	660000	92.30%	2	6	23026.5425	72618.408	73542.715	-924.307
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	83825.131	84892.080	-1066.949
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	85364.497	86451.040	-1086.543
85	B777-F	347815	766800	91.70%	2	6	26578.86292	83821.299	84888.200	-1066.900
86	B777-9	351535	775000	94.20%	2	6	27595.4975	87027.442	88135.151	-1107.709
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	87027.442	88135.151	-1107.709
88	B787-8	227930	502500	91.20%	2	4	25984.02	81945.353	82988.376	-1043.023
89	B787-9	254011	560000	92.30%	2	4	29306.51913	92423.461	93599.852	-1176.391
90	B787-10	254011	560000	93.20%	2	4	29592.2815	93324.665	94512.527	-1187.862
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	49146.202	49771.748	-625.546
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	50939.859	51588.236	-648.377
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	53809.710	54494.615	-684.905
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	59190.681	59944.077	-753.395
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	59190.681	59944.077	-753.395
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	61532.291	62315.491	-783.200
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	63583.367	64392.674	-809.307
98	A310-200	132000	291009	93.70%	2	2	30921	97515.021	98756.219	-1241.198
99	A310-300	150000	330693	94.50%	2	2	35437.5	111758.629	113181.124	-1422.494
100	A318-100	68000	149914	90.80%	2	2	15436	48680.245	49299.861	-619.616
101	A319-100	64000	141096	92.70%	2	2	14832	46775.421	47370.792	-595.370
102	A319-Neo	64000	141096	90.80%	2	2	14528	45816.702	46399.869	-583.168
103	A320-200	78000	171961	95.10%	2	2	18544.5	58483.468	59227.862	-744.394
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	58984.115	59734.881	-750.766
105	A321-100	89000	196211	95.00%	2	2	21137.5	66660.967	67509.446	-848.479
106	A321-200	93500	206132	95.30%	2	2	22276.375	70252.617	71146.812	-894.195
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	72652.964	73577.711	-924.747
108	A330-200	242000	535519	92.70%	2	4	28041.75	88434.781	89560.403	-1125.622
109	A330-200F	233000	513677	94.70%	2	4	27581.375	86982.904	88090.046	-1107.142
110	A330-300	242000	535519	93.80%	2	4	28374.5	89484.169	90623.148	-1138.979
111	A330-800	242000	533519	92.80%	2	4	28072	88530.180	89657.016	-1126.836
112	A330-900	242000	533519	93.90%	2	4	28404.75	89579.567	90719.761	-1140.193
113	A340-200	275000	606271	93.50%	2	4	32140.625	101361.332	102651.486	-1290.155
114	A340-300	276500	609578	93.80%	2	4	32419.625	102241.209	103542.563	-1301.354
115	A340-500	380000	837756	93.50%	3	4	29608.33333	93375.287	94563.794	-1188.506
116	A340-600	380000	837756	92.30%	3	4	29228.33333	92176.888	93350.141	-1173.253
117	A350-900	280000	617295	93.10%	2	4	32585	102762.749	104070.742	-1307.992
118	A350-1000	308000	679024	94.20%	2	6	24178	76249.739	77220.267	-970.528
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	71250.232	72157.125	-906.893

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	28538.384	28901.628	-363.244
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	31595.800	31997.960	-402.160
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	33124.509	33546.127	-421.618
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	32275.143	32685.950	-410.807
124	Avro RJ85	44000	97000	95.00%	2	2	10450	32955.984	33375.457	-419.473
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	34483.943	34922.864	-438.921
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13198.919	13366.919	-167.999
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	14014.296	14192.674	-178.378
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	14642.943	14829.322	-186.379
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	14642.943	14829.322	-186.379
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	16375.493	16583.925	-208.432
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	16375.493	16583.925	-208.432
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4586.497	4644.875	-58.378
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5096.108	5160.972	-64.865
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	5843.537	5917.915	-74.378
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6217.252	6296.386	-79.135
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	6913.720	7001.719	-88.000
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7304.421	7397.394	-92.973
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7304.421	7397.394	-92.973
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16120.719	16325.908	-205.189
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	18005.951	18235.136	-229.185
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	24800.876	25116.548	-315.672
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	31188.345	31585.318	-396.974
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9437.992	9558.121	-120.129
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	11534.594	11681.410	-146.815
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12133.794	12288.236	-154.442
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8541.077	8649.790	-108.713
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	11729.334	11878.628	-149.294
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10478.505	10611.878	-133.373
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	9682.318	9805.557	-123.239
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4246.828	4300.883	-54.055
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	14948.535	15138.804	-190.269
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	21913.482	22192.403	-278.921
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14230.993	14412.129	-181.136
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	37674.681	38154.215	-479.534
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	15287.082	15481.661	-194.578
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	24800.876	25116.548	-315.672
157	F-50	18990	41866	95.00%	2	2	4510.125	14223.503	14404.544	-181.041
158	F-70	39915	87998	95.00%	2	2	9479.8125	29896.320	30276.849	-380.529
159	F-100	43090	94997	95.00%	2	2	10233.875	32274.394	32685.191	-410.797
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10455.286	10588.364	-133.078
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	13419.826	13590.638	-170.811
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3635.644	3681.920	-46.275
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3601.190	3647.027	-45.837
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4246.828	4300.883	-54.055
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4204.135	4257.646	-53.511
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4711.957	4771.932	-59.975
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5649.704	5721.615	-71.911
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5717.863	5790.642	-72.779
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	4790.602	4851.578	-60.976
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4025.873	4077.115	-51.242
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3533.031	3578.001	-44.969
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	2936.828	2974.208	-37.381
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5129.898	5195.193	-65.295
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5538.103	5608.594	-70.490
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5401.785	5470.541	-68.755
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	6794.925	6881.412	-86.488
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7475.016	7570.160	-95.144
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7475.016	7570.160	-95.144
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	7814.313	7913.776	-99.463
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	6863.084	6950.439	-87.355
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	6863.084	6950.439	-87.355

t. Kemiringan 20° (g = 36,4 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	13845.553	14821.674	-976.121
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	13845.553	14821.674	-976.121
3	ATR 72-500	22800	50265	95.00%	2	2	5415	16971.968	18168.503	-1196.535
4	ATR 72-600	22800	50265	95.00%	2	2	5415	16971.968	18168.503	-1196.535
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	29979.994	32093.604	-2113.610
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	33053.707	35384.016	-2330.309
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	35698.207	38214.956	-2516.748
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	35698.207	38214.956	-2516.748
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	37681.765	40338.355	-2656.590
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	39995.430	42815.135	-2819.705
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	46275.481	49537.934	-3262.453
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	107425.458	114999.027	-7573.569
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	117341.060	125613.685	-8272.626
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	71065.943	76076.141	-5010.198
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	93697.173	100302.888	-6605.715
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	93697.173	100302.888	-6605.715
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	101717.917	108889.100	-7171.183
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	106442.525	113946.797	-7504.271
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	101717.917	108889.100	-7171.183
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	101717.917	108889.100	-7171.183
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	101717.917	108889.100	-7171.183
22	MD-81	63504	140000	92.40%	2	2	14669.424	45977.653	49219.110	-3241.456
23	MD-82	67812	149500	92.40%	2	2	15664.572	49096.697	52558.048	-3461.351
24	MD-83	72575	160000	92.40%	2	2	16764.825	52545.166	56249.636	-3704.470
25	MD-87	63503	140000	92.40%	2	2	14669.193	45976.929	49218.335	-3241.405
26	MD-88	67812	149500	92.40%	2	2	15664.572	49096.697	52558.048	-3461.351
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	26746.618	28632.273	-1885.655
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	28804.399	30835.129	-2030.730
29	B707-120B	117000	257340	97.30%	2	4	14230.125	44600.780	47745.166	-3144.386
30	B707-320	141700	312000	96.00%	2	4	17004	53294.800	57052.120	-3757.320
31	B707-420	141700	312000	96.00%	2	4	17004	53294.800	57052.120	-3757.320
32	B707-320B	148500	327000	96.00%	2	4	17820	55852.349	59789.978	-3937.629
33	B707-320C	151500	333600	96.00%	2	4	18180	56980.679	60997.856	-4017.177
34	B717-200	54884	121000	96.00%	2	2	13172.16	41284.853	44195.463	-2910.611
35	B720	104000	229300	95.00%	2	4	12350	38707.997	41436.937	-2728.940
36	B720B	106200	234300	95.00%	2	4	12611.25	39526.820	42313.488	-2786.668
37	B727-100	76700	169000	95.40%	2	2	18292.95	57334.693	61376.828	-4042.135
38	B727-100C	76700	169000	95.40%	2	2	18292.95	57334.693	61376.828	-4042.135
39	B727-200	95100	209500	93.00%	2	2	22110.75	69300.635	74186.378	-4885.743
40	B737-100	50349	110000	92.30%	2	2	11618.03175	36413.825	38981.025	-2567.200
41	B737-200	52390	115000	93.70%	2	2	12272.3575	38464.646	41176.430	-2711.784
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	38464.646	41176.430	-2711.784
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	41795.540	44742.154	-2946.614
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	42660.589	45668.190	-3007.601
45	B737-300	63276	139500	90.80%	2	2	14363.652	45019.287	48193.178	-3173.891
46	B737-400	68039	150000	93.80%	2	2	15955.1455	50007.427	53532.985	-3525.558
47	B737-500	61689	136000	92.30%	2	2	14234.73675	44615.235	47760.639	-3145.405
48	B737-600	65544	144500	91.60%	2	2	15009.576	47043.775	50360.394	-3316.619
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	50462.387	54020.020	-3557.633
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	57951.494	62037.115	-4085.620
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	57951.494	62037.115	-4085.620
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	63176.022	67629.975	-4453.953
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	55731.827	59660.960	-3929.132
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	57950.761	62036.329	-4085.569
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	58757.113	62899.530	-4142.417
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	60151.282	64391.989	-4240.707
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	65047.582	69633.482	-4585.899
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	123517.963	132226.064	-8708.101
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	121048.330	129582.321	-8533.991
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	98821.634	105788.627	-6966.993

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	136913.868	146566.390	-9652.522
62	B747-200C	362800	800000	94.10%	2	4	42674.35	133752.114	143181.730	-9429.616
63	B747-200F	356000	785000	94.00%	2	4	41830	131105.710	140348.752	-9243.043
64	B747-300	340100	750000	92.50%	2	4	39324.0625	123251.473	131940.787	-8689.314
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	98608.426	105560.388	-6951.962
66	B747-300	377800	833000	92.50%	2	4	43683.125	136913.868	146566.390	-9652.522
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	136913.868	146566.390	-9652.522
68	B747-SP	315600	698000	87.80%	2	4	34637.1	108561.357	116215.008	-7653.650
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	72538.728	77652.758	-5114.030
70	B747-8	447696	987000	94.70%	4	4	26498.007	83051.399	88906.580	-5855.181
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	81695.143	87454.707	-5759.564
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	41322.276	44235.524	-2913.249
73	B757-300	122470	270000	92.70%	2	4	14191.21125	44478.815	47614.602	-3135.787
74	B767-200	142882	315000	92.60%	2	4	16538.5915	51836.093	55490.573	-3654.480
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	63737.125	68230.637	-4493.511
76	B767-300	158758	350000	92.70%	2	4	18396.08325	57657.938	61722.862	-4064.924
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	67578.458	72342.786	-4764.328
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	67578.458	72342.786	-4764.328
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	75170.711	80470.298	-5299.587
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	69464.478	74361.772	-4897.294
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	69464.478	74361.772	-4897.294
82	B777-300	299370	660000	92.30%	2	6	23026.5425	72170.959	77259.061	-5088.102
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	83308.630	89181.946	-5873.316
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	84838.511	90819.684	-5981.173
85	B777-F	347815	766800	91.70%	2	6	26578.86292	83304.821	89177.869	-5873.047
86	B777-9	351535	775000	94.20%	2	6	27595.4975	86491.209	92588.899	-6097.690
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	86491.209	92588.899	-6097.690
88	B787-8	227930	502500	91.20%	2	4	25984.02	81440.435	87182.041	-5741.607
89	B787-9	254011	560000	92.30%	2	4	29306.51913	91853.980	98329.749	-6475.769
90	B787-10	254011	560000	93.20%	2	4	29592.2815	92749.631	99288.544	-6538.913
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	48843.380	52286.872	-3443.492
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	50625.986	54195.152	-3569.167
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	53478.154	57248.400	-3770.247
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	58825.969	62973.240	-4147.271
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	58825.969	62973.240	-4147.271
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	61153.150	65464.490	-4311.339
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	63191.589	67646.639	-4455.051
98	A310-200	132000	291009	93.70%	2	2	30921	96914.168	103746.684	-6832.516
99	A310-300	150000	330693	94.50%	2	2	35437.5	111070.012	118900.524	-7830.512
100	A318-100	68000	149914	90.80%	2	2	15436	48380.295	51791.139	-3410.844
101	A319-100	64000	141096	92.70%	2	2	14832	46487.207	49764.588	-3277.380
102	A319-Neo	64000	141096	90.80%	2	2	14528	45534.395	48744.601	-3210.206
103	A320-200	78000	171961	95.10%	2	2	18544.5	58123.113	62220.833	-4097.720
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	58620.676	62753.474	-4132.798
105	A321-100	89000	196211	95.00%	2	2	21137.5	66250.226	70920.912	-4670.687
106	A321-200	93500	206132	95.30%	2	2	22276.375	69819.745	74742.086	-4922.340
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	72205.302	77295.826	-5090.524
108	A330-200	242000	535519	92.70%	2	4	28041.75	87889.876	94086.173	-6196.297
109	A330-200F	233000	513677	94.70%	2	4	27581.375	86446.946	92541.515	-6094.569
110	A330-300	242000	535519	93.80%	2	4	28374.5	88932.798	95202.622	-6269.824
111	A330-800	242000	533519	92.80%	2	4	28072	87984.688	94187.669	-6202.981
112	A330-900	242000	533519	93.90%	2	4	28404.75	89027.609	95304.117	-6276.508
113	A340-200	275000	606271	93.50%	2	4	32140.625	100736.779	107838.791	-7102.012
114	A340-300	276500	609578	93.80%	2	4	32419.625	101611.235	108774.897	-7163.662
115	A340-500	380000	837756	93.50%	3	4	29608.33333	92799.941	99342.401	-6542.460
116	A340-600	380000	837756	92.30%	3	4	29228.33333	91608.926	98067.419	-6458.492
117	A350-900	280000	617295	93.10%	2	4	32585	102129.561	109329.766	-7200.204
118	A350-1000	308000	679024	94.20%	2	6	24178	75779.915	81122.451	-5342.536
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	70811.213	75803.453	-4992.239

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	28362.540	30362.119	-1999.579
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	31401.118	33614.919	-2213.800
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	32920.407	35241.318	-2320.911
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	32076.275	34337.674	-2261.399
124	Avro RJ85	44000	97000	95.00%	2	2	10450	32752.921	35062.024	-2309.103
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	34271.465	36687.627	-2416.162
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	13117.592	14042.391	-924.799
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	13927.945	14909.875	-981.930
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	14552.718	15578.695	-1025.977
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	14552.718	15578.695	-1025.977
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	16274.593	17421.963	-1147.370
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	16274.593	17421.963	-1147.370
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4558.237	4879.595	-321.359
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	5064.707	5421.773	-357.065
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	5807.531	6216.966	-409.435
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	6178.943	6614.563	-435.620
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	6871.120	7355.538	-484.419
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7259.414	7771.208	-511.794
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7259.414	7771.208	-511.794
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	16021.389	17150.908	-1129.519
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	17895.005	19156.615	-1261.610
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	24648.061	26385.767	-1737.705
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	30996.173	33181.425	-2185.252
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9379.838	10041.123	-661.285
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	11463.522	12271.708	-808.186
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	12059.030	12909.200	-850.170
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8488.450	9086.891	-598.442
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	11657.062	12478.893	-821.831
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10413.940	11148.130	-734.190
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	9622.659	10301.063	-678.404
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4220.660	4518.220	-297.559
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	14856.427	15903.815	-1047.388
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	21778.459	23313.855	-1535.396
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	14143.307	15140.419	-997.113
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	37442.543	40082.268	-2639.725
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	15192.889	16263.998	-1071.109
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	24648.061	26385.767	-1737.705
157	F-50	18990	41866	95.00%	2	2	4510.125	14135.863	15132.451	-996.588
158	F-70	39915	87998	95.00%	2	2	9479.8125	29712.110	31806.834	-2094.724
159	F-100	43090	94997	95.00%	2	2	10233.875	32075.531	34336.878	-2261.347
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10390.864	11123.427	-732.563
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	13337.138	14277.416	-940.277
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3613.243	3867.979	-254.736
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3579.001	3831.323	-252.322
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4220.660	4518.220	-297.559
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4178.231	4472.799	-294.568
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4682.923	5013.073	-330.149
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5614.893	6010.747	-395.854
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5682.632	6083.261	-400.629
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	4761.084	5096.743	-335.660
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	4001.067	4283.145	-282.078
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3511.262	3758.808	-247.546
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	2918.732	3124.504	-205.773
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	5098.290	5457.723	-359.433
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5503.979	5892.014	-388.034
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5368.501	5746.984	-378.483
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	6753.057	7229.152	-476.095
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7428.958	7952.705	-523.747
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7428.958	7952.705	-523.747
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	7766.164	8313.684	-547.520
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	6820.796	7301.666	-480.871
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	6820.796	7301.666	-480.871

u. Kemiringan 25° (g = 46,6 %)

No	Aircraft	MTOW	pounds	Persentase Berat Main Gear	Gandar	Jumlah Roda	Berat Pesawat pada 1 Roda	Gaya Friction (Newton)	Gaya Berat Pesawat (Newton)	Resultan Gaya
1	ATR 42-500	18600	41005	95.00%	2	2	4417.5	13353.656	18314.448	-4960.791
2	ATR 42-600	18600	41005	95.00%	2	2	4417.5	13353.656	18314.448	-4960.791
3	ATR 72-500	22800	50265	95.00%	2	2	5415	16368.998	22449.968	-6080.970
4	ATR 72-600	22800	50265	95.00%	2	2	5415	16368.998	22449.968	-6080.970
5	DC-9-15	41141	90700	93.00%	2	2	9565.2825	28914.883	39656.563	-10741.680
6	DC-9-21	45359	98000	93.00%	2	2	10545.9675	31879.395	43722.370	-11842.975
7	DC-9-32	48988	108000	93.00%	2	2	11389.71	34429.943	47220.430	-12790.487
8	DC-9-33F	48988	108000	93.00%	2	2	11389.71	34429.943	47220.430	-12790.487
9	DC-9-41	51710	114000	93.00%	2	2	12022.575	36343.030	49844.215	-13501.185
10	DC-9-51	54885	121000	93.00%	2	2	12760.7625	38574.496	52904.656	-14330.160
11	DC-9-80	63503	140000	93.00%	2	2	14764.4475	44631.433	61211.704	-16580.270
12	DC-8-61	147418	325000	93.00%	2	2	34274.685	103608.911	142098.907	-38489.997
13	DC-8-63	161025	355000	93.00%	2	2	37438.3125	113172.237	155214.944	-42042.707
14	DC-10-10	195045	430000	93.00%	2	4	22673.98125	68541.155	94003.722	-25462.567
15	DC-10-30	251744	555000	95.00%	2	4	29894.6	90368.356	123939.578	-33571.222
16	DC-10-40	251744	555000	95.00%	2	4	29894.6	90368.356	123939.578	-33571.222
17	MD-11 -Passengger	273294	602500	95.00%	2	4	32453.6625	98104.144	134549.157	-36445.014
18	MD-11 -Passengger-ER	285988	630500	95.00%	2	4	33961.075	102660.899	140798.716	-38137.817
19	MD-11-Combi	273294	602500	95.00%	2	4	32453.6625	98104.144	134549.157	-36445.014
20	MD-11-Freighter	273294	602500	95.00%	2	4	32453.6625	98104.144	134549.157	-36445.014
21	MD-11-Convertible-Freighter	273294	602500	95.00%	2	4	32453.6625	98104.144	134549.157	-36445.014
22	MD-81	63504	140000	92.40%	2	2	14669.424	44344.187	60817.747	-16473.560
23	MD-82	67812	149500	92.40%	2	2	15664.572	47352.419	64943.516	-17591.097
24	MD-83	72575	160000	92.40%	2	2	16764.825	50678.373	69505.039	-18826.666
25	MD-87	63503	140000	92.40%	2	2	14669.193	44343.489	60816.789	-16473.301
26	MD-88	67812	149500	92.40%	2	2	15664.572	47352.419	64943.516	-17591.097
27	MD-90-30	70760	156000	96.48%	2	4	8533.656	25796.380	35379.558	-9583.178
28	MD-90-30ER	76204	168000	96.48%	2	4	9190.2024	27781.054	38101.524	-10320.470
29	B707-120B	117000	257340	97.30%	2	4	14230.125	43016.231	58996.464	-15980.233
30	B707-320	141700	312000	96.00%	2	4	17004	51401.374	70496.631	-19095.257
31	B707-420	141700	312000	96.00%	2	4	17004	51401.374	70496.631	-19095.257
32	B707-320B	148500	327000	96.00%	2	4	17820	53868.060	73879.673	-20011.613
33	B707-320C	151500	333600	96.00%	2	4	18180	54956.304	75372.192	-20415.888
34	B717-200	54884	121000	96.00%	2	2	13172.16	39818.109	54610.263	-14792.153
35	B720	104000	229300	95.00%	2	4	12350	37332.803	51201.682	-13868.879
36	B720B	106200	234300	95.00%	2	4	12611.25	38122.535	52284.794	-14162.259
37	B727-100	76700	169000	95.40%	2	2	18292.95	55297.740	75840.470	-20542.730
38	B727-100C	76700	169000	95.40%	2	2	18292.95	55297.740	75840.470	-20542.730
39	B727-200	95100	209500	93.00%	2	2	22110.75	66838.564	91668.630	-24830.066
40	B737-100	50349	110000	92.30%	2	2	11618.03175	35120.136	48167.025	-13046.889
41	B737-200	52390	115000	93.70%	2	2	12272.3575	37098.097	50879.785	-13781.688
42	B737-200-Convertible-Ex	52390	115500	93.70%	2	2	12272.3575	37098.097	50879.785	-13781.688
43	B737-200 Advanced	58105	128100	91.80%	2	2	13335.0975	40310.653	55285.783	-14975.130
44	B737-200C/-200QC	58105	128100	93.70%	2	2	13611.09625	41144.969	56430.042	-15285.073
45	B737-300	63276	139500	90.80%	2	2	14363.652	43419.869	59550.051	-16130.182
46	B737-400	68039	150000	93.80%	2	2	15955.1455	48230.793	66148.201	-17917.407
47	B737-500	61689	136000	92.30%	2	2	14234.73675	43030.171	59015.584	-15985.412
48	B737-600	65544	144500	91.60%	2	2	15009.576	45372.432	62227.978	-16855.546
49	B737-700/-Winglets/-700C	70307	155000	91.60%	2	2	16100.303	48669.590	66750.007	-18080.417
50	B737-800/-800 Winglets	79016	174200	93.60%	2	2	18489.744	55892.629	76656.355	-20763.727
51	B737-900/-900 Winglets	79016	174200	93.60%	2	2	18489.744	55892.629	76656.355	-20763.727
52	B737-900ER/-900ER Winglets	85139	187700	94.70%	2	2	20156.65825	60931.542	83567.190	-22635.648
53	B737-BBJ	77564	171000	91.70%	2	2	17781.547	53751.821	73720.252	-19968.431
54	B737-BBJ2	79015	174200	93.60%	2	2	18489.51	55891.921	76655.385	-20763.464
55	B737 Max-7	80286	177000	93.40%	2	2	18746.781	56669.625	77722.001	-21052.376
56	B737 Max-8/-200-/-BBJ8	82191	181200	93.40%	2	2	19191.5985	58014.264	79566.163	-21551.899
57	B737 Max-9	88314	194700	94.00%	2	2	20753.79	62736.611	86042.830	-23306.219
58	B747-100/-100B	340100	750000	92.70%	2	4	39409.0875	119129.691	163385.551	-44255.860
59	B747-100SF	333300	735000	92.70%	2	4	38621.1375	116747.798	160118.800	-43371.003
60	B747-100B SR	272100	600000	92.70%	2	4	31529.5875	95310.758	130718.049	-35407.290

61	B747-200B/-200B Combi	377800	833000	92.50%	2	4	43683.125	132049.675	181105.219	-49055.545
62	B747-200C	362800	800000	94.10%	2	4	42674.35	129000.250	176922.954	-47922.704
63	B747-200F	356000	785000	94.00%	2	4	41830	126447.865	173422.376	-46974.511
64	B747-300	340100	750000	92.50%	2	4	39324.0625	118872.669	163033.047	-44160.378
65	B747-300SR	272100	600000	92.50%	2	4	31461.5625	95105.126	130436.025	-35330.899
66	B747-300	377800	833000	92.50%	2	4	43683.125	132049.675	181105.219	-49055.545
67	B747-300 Combi	377800	833000	92.50%	2	4	43683.125	132049.675	181105.219	-49055.545
68	B747-SP	315600	698000	87.80%	2	4	34637.1	104704.455	143601.438	-38896.984
69	B747-400 (CF6-80C2B1 engines)	396894	875000	93.30%	4	4	23143.88138	69961.616	95951.874	-25990.258
70	B747-8	447696	987000	94.70%	4	4	26498.007	80100.799	109857.694	-29756.895
71	B747-8F	442253	975000	94.30%	4	4	26065.28619	78792.727	108063.683	-29270.956
72	B757-200/-200PF	115650	255000	91.20%	2	4	13184.1	39854.203	54659.764	-14805.562
73	B757-300	122470	270000	92.70%	2	4	14191.21125	42898.598	58835.132	-15936.534
74	B767-200	142882	315000	92.60%	2	4	16538.5915	49994.492	68567.101	-18572.609
75	B767-200ER	179169	395000	90.80%	2	4	20335.6815	61472.711	84309.400	-22836.689
76	B767-300	158758	350000	92.70%	2	4	18396.08325	55609.502	76268.048	-20658.547
77	B767-300ER	186880	412000	92.30%	2	4	21561.28	65177.572	89390.591	-24213.019
78	B767-300ER Freighter	186880	412000	92.30%	2	4	21561.28	65177.572	89390.591	-24213.019
79	B767-400ER	204116	450000	94.00%	2	4	23983.63	72500.091	99433.375	-26933.284
80	B777-200 (GE engines)	286900	632500	92.70%	2	6	22163.025	66996.586	91885.356	-24888.770
81	B777-200 (P & W engines/RR engines)	286900	632500	92.70%	2	6	22163.025	66996.586	91885.356	-24888.770
82	B777-300	299370	660000	92.30%	2	6	23026.5425	69606.912	95465.401	-25858.488
83	B777-200LR	347452	766000	91.80%	2	6	26580.078	80348.891	110197.951	-29849.060
84	B777-300ER	351535	775000	92.40%	2	6	27068.195	81824.419	112221.628	-30397.208
85	B777-F	347815	766800	91.70%	2	6	26578.86292	80345.218	110192.913	-29847.695
86	B777-9	351535	775000	94.20%	2	6	27595.4975	83418.402	114407.763	-30989.362
87	B777-9X/-8X	351535	775000	94.20%	2	6	27595.4975	83418.402	114407.763	-30989.362
88	B787-8	227930	502500	91.20%	2	4	25984.02	78547.068	107726.763	-29179.695
89	B787-9	254011	560000	92.30%	2	4	29306.51913	88590.647	121501.462	-32910.815
90	B787-10	254011	560000	93.20%	2	4	29592.2815	89454.478	122686.200	-33231.722
91	A300B2-100	137000	302032	91.00%	2	4	15583.75	47108.102	64608.438	-17500.335
92	A300B2-200	142000	313056	91.00%	2	4	16152.5	48827.376	66966.410	-18139.034
93	A300B4-100	150000	330693	91.00%	2	4	17062.5	51578.214	70739.165	-19160.951
94	A300B4-600	165000	363760	91.00%	2	4	18768.75	56736.035	77813.082	-21077.046
95	A300C4-600	165000	363760	91.00%	2	4	18768.75	56736.035	77813.082	-21077.046
96	A300F4-200	165000	363760	94.60%	2	4	19511.25	58980.538	80891.402	-21910.864
97	A300F4-600	170500	375887	94.60%	2	4	20161.625	60946.556	83587.782	-22641.226
98	A310-200	132000	291009	93.70%	2	2	30921	93471.060	128194.915	-34723.855
99	A310-300	150000	330693	94.50%	2	2	35437.5	107123.983	146919.805	-39795.822
100	A318-100	68000	149914	90.80%	2	2	15436	46661.469	63995.883	-17334.414
101	A319-100	64000	141096	92.70%	2	2	14832	44835.638	61491.769	-16656.131
102	A319-Neo	64000	141096	90.80%	2	2	14528	43916.677	60231.419	-16314.743
103	A320-200	78000	171961	95.10%	2	2	18544.5	56058.150	76883.367	-20825.217
104	A320-Neo	79000	174165	94.70%	2	2	18703.25	56538.036	77541.526	-21003.491
105	A321-100	89000	196211	95.00%	2	2	21137.5	63896.527	87633.647	-23737.120
106	A321-200	93500	206132	95.30%	2	2	22276.375	67339.232	92355.292	-25016.061
107	A321-Neo	97000	213848	95.00%	2	2	23037.5	69640.036	95510.829	-25870.794
108	A330-200	242000	535519	92.70%	2	4	28041.75	84767.378	116257.875	-31490.497
109	A330-200F	233000	513677	94.70%	2	4	27581.375	83375.711	114349.213	-30973.502
110	A330-300	242000	535519	93.80%	2	4	28374.5	85773.247	117637.418	-31864.171
111	A330-800	242000	533519	92.80%	2	4	28072	84858.821	116383.288	-31524.467
112	A330-900	242000	533519	93.90%	2	4	28404.75	85864.690	117762.831	-31898.141
113	A340-200	275000	606271	93.50%	2	4	32140.625	97157.863	133251.340	-36093.477
114	A340-300	276500	609578	93.80%	2	4	32419.625	98001.252	134408.042	-36406.790
115	A340-500	380000	837756	93.50%	3	4	29608.33333	89503.001	122752.749	-33249.748
116	A340-600	380000	837756	92.30%	3	4	29228.33333	88354.299	121177.313	-32823.014
117	A350-900	280000	617295	93.10%	2	4	32585	98501.164	135093.668	-36592.504
118	A350-1000	308000	679024	94.20%	2	6	24178	73087.652	100239.211	-27151.559
119	A380-800	575000	1267658	94.30%	4	6	22592.70833	68295.475	93666.774	-25371.299

120	BAE146-100A	38102	84000	95.00%	2	2	9049.225	27354.893	37517.048	-10162.154
121	BAE146-200	42184	93000	95.00%	2	2	10018.7	30285.518	41536.380	-11250.861
122	BAE146-300	44225	97500	95.00%	2	2	10503.4375	31750.831	43546.046	-11795.215
123	Avro RJ70	43091	95000	95.00%	2	2	10234.1125	30936.688	42429.455	-11492.767
124	Avro RJ85	44000	97000	95.00%	2	2	10450	31589.294	43324.500	-11735.205
125	Avro RJ100	46040	101500	95.00%	2	2	10934.5	33053.889	45333.181	-12279.292
126	Bombardier Challenger 300	17622	38850	95.00%	2	2	4185.240124	12651.558	17351.525	-4699.967
127	Bombardier CL-600	18711	41250	95.00%	2	2	4443.787776	13433.122	18423.434	-4990.312
128	Bombardier CL-601-3A	19550	43100	95.00%	2	2	4643.125	14035.698	19249.863	-5214.165
129	Bombardier CL-601-3R	19550	43100	95.00%	2	2	4643.125	14035.698	19249.863	-5214.165
130	Bombardier CL-604	21863	48200	95.00%	2	2	5192.498687	15696.399	21527.503	-5831.104
131	Bombardier CL-605	21863	48200	95.00%	2	2	5192.498687	15696.399	21527.503	-5831.104
132	LEARJET-24D	6123	13500	95.00%	2	2	1454.330545	4396.294	6029.487	-1633.193
133	LEARJET-25D	6804	15000	95.00%	2	2	1615.922828	4884.771	6699.430	-1814.659
134	LEARJET-31A	7802	17200	95.00%	2	2	1852.924843	5601.205	7682.014	-2080.809
135	LEARJET-35A/-36A	8301	18300	95.00%	2	2	1971.42585	5959.421	8173.305	-2213.884
136	LEARJET-40	9231	20350	95.00%	2	2	2192.268636	6627.007	9088.894	-2461.887
137	LEARJET-45X	9752	21500	95.00%	2	2	2316.156053	7001.506	9602.517	-2601.011
138	LEARJET-55	9752	21500	95.00%	2	2	2316.156053	7001.506	9602.517	-2601.011
139	Bombardier CRJ-100/-200	21523	47450	95.00%	2	2	5111.7125	15452.191	21192.573	-5740.382
140	Bombardier CRJ-200LR	24040	53000	95.00%	2	2	5709.5	17259.242	23670.931	-6411.689
141	Bombardier CRJ700	33112	72750	95.00%	2	2	7864.1	23772.380	32603.655	-8831.275
142	Bombardier CRJ1000	41640	91800	95.00%	2	2	9889.5	29894.960	41000.731	-11105.772
143	CASA 212-100/-100B4/-200	6300	13890	95.00%	2	1	2992.689077	9046.597	12407.345	-3360.748
144	CASA 212-300	7700	16976	95.00%	2	1	3657.5	11056.253	15163.575	-4107.322
145	CASA 212-400	8100	17850	95.00%	2	1	3847.5	11630.604	15951.293	-4320.689
146	Dornier 228-100/-212	5702	12570	95.00%	2	1	2708.286659	8186.877	11228.245	-3041.368
147	Dornier 328 Jet/-300	15660	34524	95.00%	2	2	3719.25	11242.917	15419.583	-4176.666
148	Dornier 328-100	13990	30842	95.00%	2	2	3322.625	10043.960	13775.222	-3731.262
149	DHC4A CARIBOU	12927	28500	95.00%	2	2	3070.1625	9280.791	12728.541	-3447.750
150	DHC6-300 Twin Otter	5670	12500	95.00%	2	2	1346.625	4070.711	5582.953	-1512.241
151	DHC7 Dash 7	19958	44000	95.00%	2	2	4740.025	14328.617	19651.599	-5322.982
152	DHC8 Dash 8	29257	64500	95.00%	2	2	6948.5375	21004.727	28807.838	-7803.111
153	EMB135BJ	19000	41888	95.00%	2	2	4512.5	13640.832	18708.307	-5067.475
154	ERJ190-100LR	50300	110892	95.00%	2	2	11946.25	36112.307	49527.780	-13415.473
155	F-27 Friendship	20410	44996	95.00%	2	2	4847.375	14653.125	20096.660	-5443.535
156	F-28 Fellowship	33112	73000	95.00%	2	2	7864.1	23772.380	32603.655	-8831.275
157	F-50	18990	41866	95.00%	2	2	4510.125	13633.652	18698.460	-5064.808
158	F-70	39915	87998	95.00%	2	2	9479.8125	28656.516	39302.214	-10645.698
159	F-100	43090	94997	95.00%	2	2	10233.875	30935.970	42428.470	-11492.500
160	Cessna Citation Sovereign	13959	30775	95.00%	2	2	3315.2625	10021.704	13744.698	-3722.994
161	Cessna Citation Longitude	17917	39500	95.00%	2	2	4255.2875	12863.304	17641.933	-4778.629
162	Cessna Citation CJ1+	4854	10700	95.00%	2	2	1152.825	3484.874	4779.480	-1294.607
163	Cessna Citation CJ1	4808	10600	95.00%	2	2	1141.9	3451.848	4734.186	-1282.338
164	Cessna Citation CJ2+	5670	12500	95.00%	2	2	1346.625	4070.711	5582.953	-1512.241
165	Cessna Citation CJ2	5613	12375	95.00%	2	2	1333.0875	4029.789	5526.828	-1497.039
166	Cessna Citation CJ3	6291	13870	95.00%	2	2	1494.1125	4516.551	6194.419	-1677.868
167	Cessna Citation Encore	7543	16630	95.00%	2	2	1791.4625	5415.410	7427.198	-2011.788
168	Cessna Citation Encore+	7634	16830	95.00%	2	2	1813.075	5480.743	7516.801	-2036.058
169	Cessna Citation II/-IISP	6396	14100	95.00%	2	2	1519.05	4591.935	6297.807	-1705.872
170	Cessna Citation I/-ISP	5375	11850	95.00%	2	2	1276.5625	3858.919	5292.482	-1433.562
171	Cessna Citation Jet	4717	10400	95.00%	2	2	1120.2875	3386.516	4644.583	-1258.067
172	Cessna Citation Mustang	3921	8645	95.00%	2	2	931.2375	2815.037	3860.804	-1045.767
173	Cessna Citation S/II	6849	15100	95.00%	2	2	1626.6375	4917.161	6743.852	-1826.691
174	Cessna Citation Ultra	7394	16300	95.00%	2	2	1756.075	5308.437	7280.485	-1972.048
175	Cessna Citation V	7212	15900	95.00%	2	2	1712.85	5177.773	7101.279	-1923.507
176	Cessna Citation Excel	9072	20000	95.00%	2	2	2154.6	6513.138	8932.724	-2419.586
177	Cessna Citation III	9980	22000	95.00%	2	2	2370.25	7165.026	9826.784	-2661.758
178	Cessna Citation VI	9980	22000	95.00%	2	2	2370.25	7165.026	9826.784	-2661.758
179	Cessna Citation VII	10433	23000	95.00%	2	2	2477.8375	7490.252	10272.830	-2782.577
180	Cessna Citation XLS	9163	20200	95.00%	2	2	2176.2125	6578.471	9022.327	-2443.857
181	Cessna Citation XLS+	9163	20200	95.00%	2	2	2176.2125	6578.471	9022.327	-2443.857

LAMPIRAN II
Perhitungan Kecepatan Memasuki Exit Taxiway

a. Gradien 0,5° (g = 0,87 %)

No	Aircraft	MLW		Propulsion	engines	n	Power engines				Engine	V taxiing Calculate	V taxiing range	V taxiing range	Control
		Kg	Lbs			Engine	kN	kW	hp	lbf	efficiency		(knots)	(m/s)	
1	DC-9-15	37059	81700	2 Turbofan Engines	Pratt & Whitney JT8D-7	2	62.3			14000	0.75	29.44429415	10-20 knot	5.2-10.3	OK
2	DC-9-21	43227	95300	2 Turbofan Engines	Pratt & Whitney JT8D-11	2	66.7			15000	0.75	27.04599548	10-20 knot	5.2-10.3	OK
3	DC-9-32	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-15	2	68.95			15500	0.75	26.90259256	10-20 knot	5.2-10.3	OK
4	DC-9-33F	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3			14500	0.75	25.16694143	10-20 knot	5.2-10.3	OK
5	DC-9-41	46266	102000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	26.95410012	10-20 knot	5.2-10.3	OK
6	DC-9-51	49895	110000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	24.9936546	10-20 knot	5.2-10.3	OK
7	DC-9-80	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	21.4787874	10-20 knot	5.2-10.3	OK
8	DC-8-61	108862	240000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	25.77466326	10-20 knot	5.2-10.3	OK
9	DC-8-63	117027	258000	4 Turbofan Engines	Pratt & Whitney JT3D-7	4	84.5			19000	0.75	25.30837919	10-20 knot	5.2-10.3	OK
10	DC-10-10	164881	363500	3 Turbofan Engines	General Electric CF6-6D	3	185			41500	0.75	29.42629274	10-20 knot	5.2-10.3	OK
11	DC-10-30	182798	403000	3 Turbofan Engines	General Electric CF6-50C	3	226			50800	0.75	32.49004701	10-20 knot	5.2-10.3	OK
12	DC-10-40	182798	403000	3 Turbofan Engines	Pratt and Whitney JT9D-20	3	219.7			49400	0.75	31.59465201	10-20 knot	5.2-10.3	OK
13	MD-11 -Passengger	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	36.37757152	10-20 knot	5.2-10.3	OK
14	MD-11 -Passengger-ER	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	36.37757152	10-20 knot	5.2-10.3	OK
15	MD-11-Combi	207749	458000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	34.1535823	10-20 knot	5.2-10.3	OK
16	MD-11-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	33.17579005	10-20 knot	5.2-10.3	OK
17	MD-11-Convertible-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	33.17579005	10-20 knot	5.2-10.3	OK
18	MD-81	58061	128000	2 Turbofan Engines	Pratt & Whitney JT8D-209	2	82.3			18500	0.75	24.83442019	10-20 knot	5.2-10.3	OK
19	MD-82	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217A	2	89			20000	0.75	26.4355147	10-20 knot	5.2-10.3	OK
20	MD-83	63276	139500	2 Turbofan Engines	Pratt & Whitney JT8D-219	2	93.4			21000	0.75	25.8670609	10-20 knot	5.2-10.3	OK
21	MD-87	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89			20000	0.75	26.84848425	10-20 knot	5.2-10.3	OK
22	MD-88	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89			20000	0.75	26.4355147	10-20 knot	5.2-10.3	OK
23	MD-90-30	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2525-D5	2	111.2			25000	0.75	30.25196001	10-20 knot	5.2-10.3	OK
24	MD-90-30ER	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2528-D5	2	124.5			28000	0.75	33.88219521	10-20 knot	5.2-10.3	OK
25	B707-120B	86300	190000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	32.51310999	10-20 knot	5.2-10.3	OK
26	B707-320	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	29.84980204	10-20 knot	5.2-10.3	OK
27	B707-420	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	29.84980204	10-20 knot	5.2-10.3	OK
28	B707-320B	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	29.84980204	10-20 knot	5.2-10.3	OK
29	B707-320C	112100	247000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	25.03016407	10-20 knot	5.2-10.3	OK
30	B717-200	49898	110000	2 Turbofan Engines	Rolls-Royce BR700-715C1-30	2	95.3			21430	0.75	33.47386347	10-20 knot	5.2-10.3	OK
31	B720	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3C-7	4	53.4			12000	0.75	23.52940371	10-20 knot	5.2-10.3	OK
32	B720B	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3D-1	4	75.62			17000	0.75	33.33332192	10-20 knot	5.2-10.3	OK
33	B727-100	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3			14500	0.75	26.20123659	10-20 knot	5.2-10.3	OK
34	B727-100C	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3			14500	0.75	26.20123659	10-20 knot	5.2-10.3	OK
35	B727-200	73100	161000	3 Turbofan Engines	Pratt & Whitney JT8D-17	3	71.2			16000	0.75	25.58943358	10-20 knot	5.2-10.3	OK
36	B737-100	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3			14500	0.75	25.16694143	10-20 knot	5.2-10.3	OK
37	B737-200	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	26.69217458	10-20 knot	5.2-10.3	OK
38	B737-200-Convertible-Ex	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	26.69217458	10-20 knot	5.2-10.3	OK
39	B737-200 Advanced	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	25.69453159	10-20 knot	5.2-10.3	OK
40	B737-200C/-200QC	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	25.69453159	10-20 knot	5.2-10.3	OK
41	B737-300	52889	116000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9			22000	0.75	32.42083032	10-20 knot	5.2-10.3	OK
42	B737-400	56245	124000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9			22000	0.75	30.48635959	10-20 knot	5.2-10.3	OK
43	B737-500	49895	110000	2 Turbofan Engines	CFM Intl. CFM56-3C1	2	104.5			23500	0.75	36.7094302	10-20 knot	5.2-10.3	OK
44	B737-600	51936	121500	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	33.01573658	10-20 knot	5.2-10.3	OK
45	B737-700/-Winglets/-700C	58604	129200	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	29.25918529	10-20 knot	5.2-10.3	OK
46	B737-800/-800 Winglets	66361	146300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	32.06391388	10-20 knot	5.2-10.3	OK
47	B737-900/-900 Winglets	66814	147300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	31.84652002	10-20 knot	5.2-10.3	OK
48	B737-900ER/-900ER Winglets	71350	157300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	29.82191155	10-20 knot	5.2-10.3	OK
49	B737-BBJ	60781	134000	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	28.21120572	10-20 knot	5.2-10.3	OK
50	B737-BBJ2	66360	146300	2 Turbofan Engines	CFM Intl. CFM56-7B26	2	117.4			26400	0.75	31.00732902	10-20 knot	5.2-10.3	OK
51	B737 Max-7	66043	145600	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	33.04441339	10-20 knot	5.2-10.3	OK
52	B737 Max-8/-200-/-BBJ8	69308	152800	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	31.4877387	10-20 knot	5.2-10.3	OK

53	B737 Max-9	74343	163900	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	29.35518063	10-20 knot	5.2-10.3	OK
54	B747-100/-100B	265300	585000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	28.20335612	10-20 knot	5.2-10.3	OK
55	B747-100SF	255800	584000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	29.25078334	10-20 knot	5.2-10.3	OK
56	B747-100B SR	273500	564000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	27.35777104	10-20 knot	5.2-10.3	OK
57	B747-200B/-200B Combi	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	27.27465663	10-20 knot	5.2-10.3	OK
58	B747-200C	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	27.27465663	10-20 knot	5.2-10.3	OK
59	B747-200F	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	27.27465663	10-20 knot	5.2-10.3	OK
60	B747-300	255800	564000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	32.29773994	10-20 knot	5.2-10.3	OK
61	B747-300SR	242630	535000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	34.05086707	10-20 knot	5.2-10.3	OK
62	B747-300	260320	574000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	31.73694636	10-20 knot	5.2-10.3	OK
63	B747-300 Combi	274380	605000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	30.1106563	10-20 knot	5.2-10.3	OK
64	B747-SP	204100	450000	4 Turbofan Engines	Pratt & Whitney JT9D-7FW	4	218.4			49100	0.75	37.50034742	10-20 knot	5.2-10.3	OK
65	B747-400 (CF6-80C2B1 engines)	285764	630000	4 Turbofan Engines	General Electric CF6-80C2B1F	4	254.3			57160	0.75	31.18038746	10-20 knot	5.2-10.3	OK
66	B747-8	312072	688000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8			66498	0.75	33.21624867	10-20 knot	5.2-10.3	OK
67	B747-8F	345184	761000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8			66498	0.75	30.02995839	10-20 knot	5.2-10.3	OK
68	B757-200/-200PF	92250	210000	2 Turbofan Engines	Rolls-Royce RB.211-535E4-37	2	189			42500	0.75	35.90784678	10-20 knot	5.2-10.3	OK
69	B757-300	101610	224000	2 Turbofan Engines	Pratt & Whitney PW2043	2	189.49			42600	0.75	32.6768328	10-20 knot	5.2-10.3	OK
70	B767-200	123377	272000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5			48000	0.75	30.32311686	10-20 knot	5.2-10.3	OK
71	B767-200ER	136078	300000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5			48000	0.75	27.49287313	10-20 knot	5.2-10.3	OK
72	B767-300	136078	300000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	34.36609141	10-20 knot	5.2-10.3	OK
73	B767-300ER	145150	320000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	32.2181811	10-20 knot	5.2-10.3	OK
74	B767-300ER Freighter	147871	326000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	31.62532874	10-20 knot	5.2-10.3	OK
75	B767-400ER	158757	350000	2 Turbofan Engines	General Electric CF6-80C2B8F	2	282.46			63500	0.75	31.17508526	10-20 knot	5.2-10.3	OK
76	B777-200 (GE engines)	208700	460000	2 Turbofan Engines	General Electric GE90-94B	2	416.798			93700	0.75	34.99322345	10-20 knot	5.2-10.3	OK
77	B777-200 (P & W engines/RR engines)	206350	455000	2 Turbofan Engines	Pratt & Whitney PW4077	2	343.4			77200	0.75	29.15947062	10-20 knot	5.2-10.3	OK
78	B777-300	237680	524000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	36.32094307	10-20 knot	5.2-10.3	OK
79	B777-200LR	223168	492000	2 Turbofan Engines	General Electric GE90-115B	2	513.9			115540	0.75	40.35220303	10-20 knot	5.2-10.3	OK
80	B777-300ER	251290	554000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	34.35378148	10-20 knot	5.2-10.3	OK
81	B777-F	260816	575000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	33.09904971	10-20 knot	5.2-10.3	OK
82	B777-9	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5			78129	0.75	22.87053944	10-20 knot	5.2-10.3	OK
83	B777-9X/-8X	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5			78129	0.75	22.87053944	10-20 knot	5.2-10.3	OK
84	B787-8	172365	380000	2 Turbofan Engines	General Electric GEnx-1B70	2	321.6			72300	0.75	32.69309389	10-20 knot	5.2-10.3	OK
85	B787-9	192778	425000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6			78129	0.75	31.58796175	10-20 knot	5.2-10.3	OK
86	B787-10	201848	445000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6			78129	0.75	30.16856293	10-20 knot	5.2-10.3	OK
87	A300B2-100	127500	281089	2 Turbofan Engines	General Electric CF6-50C	2	226.859			51000	0.75	31.17645991	10-20 knot	5.2-10.3	OK
88	A300B2-200	130000	286600	2 Turbofan Engines	General Electric CF6-50C2	2	233.53			52500	0.75	31.47623356	10-20 knot	5.2-10.3	OK
89	A300B4-100	133000	293214	2 Turbofan Engines	General Electric CF6-50C2	2	233.53			52500	0.75	30.76624333	10-20 knot	5.2-10.3	OK
90	A300B4-600	134000	295419	2 Turbofan Engines	Pratt & Whitney PW4158	2	258			58000	0.75	33.73572154	10-20 knot	5.2-10.3	OK
91	A300C4-600	136000	299828	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3			60100	0.75	34.44311104	10-20 knot	5.2-10.3	OK
92	A300F4-200	136000	299828	2 Turbofan Engines	General Electric CF6-50C1	2	233.53			52500	0.75	30.0875762	10-20 knot	5.2-10.3	OK
93	A300F4-600	140000	308646	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3			60100	0.75	33.45902215	10-20 knot	5.2-10.3	OK
94	A310-200	118500	261247	2 Turbofan Engines	General Electric CF6-80A2	2	222.411			50000	0.75	32.88656109	10-20 knot	5.2-10.3	OK
95	A310-300	123000	271168	2 Turbofan Engines	Pratt & Whitney PW4152	2	232.197			52200	0.75	33.07746356	10-20 knot	5.2-10.3	OK
96	A318-100	57500	125766	2 Turbofan Engines	Pratt & Whitney PW6122	2	97.86			22000	0.75	29.82096165	10-20 knot	5.2-10.3	OK
97	A319-100	61000	134482	2 Turbofan Engines	CFM Intl. CFM56-5B5	2	97.86			22000	0.75	28.10992287	10-20 knot	5.2-10.3	OK
98	A319-Neo	62800	138450	2 Turbofan Engines	IAE International Aero Engines V2524-A5	2	104.533			23500	0.75	29.16587611	10-20 knot	5.2-10.3	OK
99	A320-200	64500	142198	2 Turbofan Engines	CFM Intl. CFM56-5A1	2	111.206			25000	0.75	30.20974797	10-20 knot	5.2-10.3	OK
100	A320-Neo	66300	146166	2 Turbofan Engines	IAE International Aero Engines V2527-A5	2	117.878			26500	0.75	31.15294825	10-20 knot	5.2-10.3	OK
101	A321-100	75500	166449	2 Turbofan Engines	FM Intl. CFM56-5B1/P	2	133.447			30000	0.75	30.96999329	10-20 knot	5.2-10.3	OK
102	A321-200	77800	171520	2 Turbofan Engines	FM Intl. CFM56-5B3/2P	2	142.3			32000	0.75	32.05805646	10-20 knot	5.2-10.3	OK
103	A321-Neo	79200	174606	2 Turbofan Engines	IAE International Aero Engines V2533-A5	2	146.791			33000	0.75	32.47547907	10-20 knot	5.2-10.3	OK
104	A330-200	180000	396832	2 Turbofan Engines	General Electric CF6-80E1A2	2	300.255			67500	0.75	29.22793117	10-20 knot	5.2-10.3	OK
105	A330-200F	182000	401241	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	29.37781799	10-20 knot	5.2-10.3	OK

106	A330-300	187000	412264	2 Turbofan Engines	Pratt & Whitney PW4164	2	284.686			64000	0.75	26.67504591	10-20 knot	5.2-10.3	OK
107	A330-800	186000	410060	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	28.74603696	10-20 knot	5.2-10.3	OK
108	A330-900	191000	421083	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	27.9935229	10-20 knot	5.2-10.3	OK
109	A340-200	185000	407855	4 Turbofan Engines	CFM Intl. CFM56-5C2	4	138.785			31200	0.75	26.28933917	10-20 knot	5.2-10.3	OK
110	A340-300	192000	410060	4 Turbofan Engines	CFM Intl. CFM56-5C4	4	151.2			34000	0.75	27.60415721	10-20 knot	5.2-10.3	OK
111	A340-500	246000	542337	4 Turbofan Engines	Rolls-Royce Trent 553-61	4	235.756			53000	0.75	33.58439787	10-20 knot	5.2-10.3	OK
112	A340-600	265000	584225	4 Turbofan Engines	Rolls-Royce Trent 556-61	4	249.1			56000	0.75	32.94116519	10-20 knot	5.2-10.3	OK
113	A350-900	205000	451948	2 Turbofan Engines	Trent XWB-84	2	373			84000	0.75	31.93686137	10-20 knot	5.2-10.3	OK
114	A350-1000	233000	513677	2 Turbofan Engines	Trent XWB-97	2	431.5			97000	0.75	32.44760312	10-20 knot	5.2-10.3	OK
115	A380-800	395000	870826	4 Turbofan engines	Engine Alliance GP7270	4	311.376			70000	0.75	27.62471131	10-20 knot	5.2-10.3	OK
116	BAE146-100A	35153	77499	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803			6700	0.75	29.71044881	10-20 knot	5.2-10.3	OK
117	BAE146-200	36741	81000	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041			6970	0.75	29.57185781	10-20 knot	5.2-10.3	OK
118	BAE146-300	38329	84501	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617			7500	0.75	30.50215885	10-20 knot	5.2-10.3	OK
119	Avro RJ70	37875	83500	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803			6700	0.75	27.57521867	10-20 knot	5.2-10.3	OK
120	Avro RJ85	38556	85001	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041			6970	0.75	28.17978078	10-20 knot	5.2-10.3	OK
121	Avro RJ100	40143	88500	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617			7500	0.75	29.12381353	10-20 knot	5.2-10.3	OK
122	Bombardier Challenger 300	15309	33750	2 Turbofan engines	Honeywell HTF 7000 (AS907)	2	28.9134			6500	0.75	33.09334329	10-20 knot	5.2-10.3	OK
123	Bombardier CL-600	16329	36000	2 Turbofan enginess	Avco Lycoming ALF502L	2	33.3617			7500	0.75	35.7980877	10-20 knot	5.2-10.3	OK
124	Bombardier CL-601-3A	16329	36000	2 Turbofan enginess	General Electric CF34-3A	2	41			9220	0.75	44.00778247	10-20 knot	5.2-10.3	OK
125	Bombardier CL-601-3R	16329	36000	2 Turbofan enginess	General Electric CF34-3A	2	41			9220	0.75	44.00778247	10-20 knot	5.2-10.3	OK
126	Bombardier CL-604	17237	38000	2 Turbofan enginess	General Electric CF34-3B	2	41			9220	0.75	41.6915834	10-20 knot	5.2-10.3	OK
127	Bombardier CL-605	17237	38000	2 Turbofan enginess	General Electric CF34-3B1	2	41			9220	0.75	41.6915834	10-20 knot	5.2-10.3	OK
128	LEARJET-24D	5389	11880	2 Turbojet engines	General Electric CJ610-6	2	13.1			2950	0.75	42.66842776	10-20 knot	5.2-10.3	OK
129	LEARJET-25D	6033	13300	2 Turbojet engines	General Electric CJ610-8A	2	13.1			2950	0.75	38.11285126	10-20 knot	5.2-10.3	OK
130	LEARJET-31A	7257	16000	2 Turbofan engines	Garrett TFE731-2	2	15.6			3500	0.75	37.58799208	10-20 knot	5.2-10.3	OK
131	LEARJET-35A/-36A	6940	15300	2 Turbofan engines	Garrett TFE731-2-2B	2	15.6			3500	0.75	39.30770414	10-20 knot	5.2-10.3	OK
132	LEARJET-40	8709	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20AR	2	15.6			3500	0.75	31.32332673	10-20 knot	5.2-10.3	OK
133	LEARJET-45X	8709	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20BR	2	15.6			3500	0.75	31.32332673	10-20 knot	5.2-10.3	OK
134	LEARJET-55	8165	18000	2 Turbofan engines	Garrett TFE731-3A-2B	2	16.236			3650	0.75	34.84347202	10-20 knot	5.2-10.3	OK
135	Bombardier CRJ-100/-200	20276	44700	2 Turbofan engines	General Electric CF34-3A1	2	41			9220	0.75	35.44177357	10-20 knot	5.2-10.3	OK
136	Bombardier CRJ-200LR	21319	47000	2 Turbofan engines	General Electric CF34-3B1	2	41			9220	0.75	33.70783812	10-20 knot	5.2-10.3	OK
137	Bombardier CRJ700	30390	67000	2 Turbofan engines	General Electric CF34-8C1	2	60.9			13700	0.75	35.13635248	10-20 knot	5.2-10.3	OK
138	Bombardier CRJ1000	36968	81500	2 Turbofan engines	General Electric CF34-8C5A1	2	64.4992			14500	0.75	30.57094438	10-20 knot	5.2-10.3	OK
139	Dornier 328 Jet/-300	14390	31724	2 Turbofan engines	Pratt & Whitney Canada PW306B	2	26.9			6050	0.75	32.76886422	10-20 knot	5.2-10.3	OK
140	EMB135BJ	18500	40785	2 Turbofan engines	Allison / Rolls-Royce AE3007A1/3	2	32.0272			7200	0.75	30.33385288	10-20 knot	5.2-10.3	OK
141	ERJ190-100LR	43000	94799	2 Turbofan engines	General Electric CF34-10E5	2	82.3			18500	0.75	33.53282025	10-20 knot	5.2-10.3	OK
142	F-28 Fellowship	29030	64000	2 Turbofan engines	Rolls-Royce RB.183 Spey Mk.555-15P	2	44.0374			9900	0.75	26.57999941	10-20 knot	5.2-10.3	OK
143	F-70	36740	81000	2 Turbofan engines	Rolls-Royce Tay 620-15	2	616			13850	0.75	29.38173447	10-20 knot	5.2-10.3	OK
144	F-100	38780	88000	2 Turbofan engines	Rolls-Royce Tay 650-15	2	672			15100	0.75	30.34841056	10-20 knot	5.2-10.3	OK
145	Cessna Citation Sovereign	12508	27575	2 Turbofan engines	Pratt & Whitney Canada PW306C	2	25.2926			5686	0.75	35.43119424	10-20 knot	5.2-10.3	OK
146	Cessna Citation Longitude	15195	33500	2 Turbofan engines	Honeywell HTF7700L	2	33.81			7600	0.75	38.98339837	10-20 knot	5.2-10.3	OK
147	Cessna Citation CJ1+	4491	9900	2 Turbofan engines	Williams / Rolls-Royce FJ44-1AP	2	8.5			1900	0.75	32.9776323	10-20 knot	5.2-10.3	OK
148	Cessna Citation CJ1	4445	9800	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5			1900	0.75	33.31413875	10-20 knot	5.2-10.3	OK
149	Cessna Citation CJ2+	5228	11525	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447			3000	0.75	44.72819634	10-20 knot	5.2-10.3	OK
150	Cessna Citation CJ2	5216	11500	2 Turbofan engines	Williams / Rolls-Royce FJ44-2C	2	10.6757			2400	0.75	35.86034524	10-20 knot	5.2-10.3	OK
151	Cessna Citation CJ3	5783	12750	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447			3000	0.75	40.4307814	10-20 knot	5.2-10.3	OK
152	Cessna Citation Encore	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	40.93417122	10-20 knot	5.2-10.3	OK
153	Cessna Citation Encore+	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	40.93417122	10-20 knot	5.2-10.3	OK
154	Cessna Citation II/-IISP	6123	13500	2 Turbofan engines	Pratt & Whitney Canada JT15D-4	2	11.1			2500	0.75	31.8205224	10-20 knot	5.2-10.3	OK
155	Cessna Citation I/-ISP	5148	11350	2 Turbofan engines	Pratt & Whitney Canada JT15D-1A	2	9.8			2200	0.75	33.30641463	10-20 knot	5.2-10.3	OK
156	Cessna Citation Jet	4400	9700	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5			1900	0.75	33.65758348	10-20 knot	5.2-10.3	OK
157	Cessna Citation Mustang	3629	8000	2 Turbofan engines	Pratt & Whitney Canada PW615F	2	6.0051			1350	0.75	28.99645103	10-20 knot	5.2-10.3	OK
158	Cessna Citation S/II	6350	14000	2 Turbofan engines	Pratt & Whitney Canada JT15D-4B	2	11.1			2500	0.75	30.68407517	10-20 knot	5.2-10.3	OK
159	Cessna Citation Ultra	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	40.93417122	10-20 knot	5.2-10.3	OK
160	Cessna Citation V	6895	15200	2 Turbofan engines	Pratt & Whitney Canada JT15D-5A	2	12.8998			2900	0.75	32.78351189	10-20 knot	5.2-10.3	OK
161	Cessna Citation Excel	8482	18700	2 Turbofan engines	Pratt & Whitney Canada PW545A	2	16.8321			3784	0.75	34.770472	10-20 knot	5.2-10.3	OK
162	Cessna Citation III	9072	20000	2 Turbofan engines	Garrett TFE731-3-100S	2	16.2			3650	0.75	31.35912482	10-20 knot	5.2-10.3	OK
163	Cessna Citation VI	9072	20000	2 Turbofan engines	Garrett TFE731-3B-100	2	16.2			3650	0.75	31.35912482	10-20 knot	5.2-10.3	OK
164	Cessna Citation VII	9072	20000	2 Turbofan engines	Garrett TFE731-4	2	18.1487			4080	0.75	35.05348747	10-20 knot	5.2-10.3	OK
165	Cessna Citation XLS	8482	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C	2	28.6554			6442	0.75	59.19433949	10-20 knot	5.2-10.3	OK
166	Cessna Citation XLS+	8482	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C1	2	30.0878			6764	0.75	62.15313758	10-20 knot	5.2-10.3	OK

b. Gradien 1° (g = 1,75 %)

No	Aircraft	MLW		Propulsion	engines	n	Power engines				Engine	V taxiing Calculate	V taxiing range	V taxiing range	Control
		Kg	Lbs			Engine	kN	kW	hp	lbf	efficiency		(knots)	(m/s)	
1	DC-9-15	37059	81700	2 Turbofan Engines	Pratt & Whitney JT8D-7	2	62.3			14000	0.75	14.72270767	10-20 knot	5.2-10.3	OK
2	DC-9-21	43227	95300	2 Turbofan Engines	Pratt & Whitney JT8D-11	2	66.7			15000	0.75	13.52351267	10-20 knot	5.2-10.3	OK
3	DC-9-32	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-15	2	68.95			15500	0.75	13.45180848	10-20 knot	5.2-10.3	OK
4	DC-9-33F	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3			14500	0.75	12.58394987	10-20 knot	5.2-10.3	OK
5	DC-9-41	46266	102000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	13.47756325	10-20 knot	5.2-10.3	OK
6	DC-9-51	49895	110000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	12.49730316	10-20 knot	5.2-10.3	OK
7	DC-9-80	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	10.73980264	10-20 knot	5.2-10.3	OK
8	DC-8-61	108862	240000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	12.88782236	10-20 knot	5.2-10.3	OK
9	DC-8-63	117027	258000	4 Turbofan Engines	Pratt & Whitney JT3D-7	4	84.5			19000	0.75	12.65467145	10-20 knot	5.2-10.3	OK
10	DC-10-10	164881	363500	3 Turbofan Engines	General Electric CF6-6D	3	185			41500	0.75	14.71370662	10-20 knot	5.2-10.3	OK
11	DC-10-30	182798	403000	3 Turbofan Engines	General Electric CF6-50C	3	226			50800	0.75	16.24564209	10-20 knot	5.2-10.3	OK
12	DC-10-40	182798	403000	3 Turbofan Engines	Pratt and Whitney JT9D-20	3	219.7			49400	0.75	15.79792754	10-20 knot	5.2-10.3	OK
13	MD-11 -Passengger	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	18.18947836	10-20 knot	5.2-10.3	OK
14	MD-11 -Passengger-ER	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	18.18947836	10-20 knot	5.2-10.3	OK
15	MD-11-Combi	207749	458000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	17.07744141	10-20 knot	5.2-10.3	OK
16	MD-11-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	16.58852667	10-20 knot	5.2-10.3	OK
17	MD-11-Convertible-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	16.58852667	10-20 knot	5.2-10.3	OK
18	MD-81	58061	128000	2 Turbofan Engines	Pratt & Whitney JT8D-209	2	82.3			18500	0.75	12.41768292	10-20 knot	5.2-10.3	OK
19	MD-82	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217A	2	89			20000	0.75	13.21826066	10-20 knot	5.2-10.3	OK
20	MD-83	63276	139500	2 Turbofan Engines	Pratt & Whitney JT8D-219	2	93.4			21000	0.75	12.93402294	10-20 knot	5.2-10.3	OK
21	MD-87	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89			20000	0.75	13.4247533	10-20 knot	5.2-10.3	OK
22	MD-88	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89			20000	0.75	13.21826066	10-20 knot	5.2-10.3	OK
23	MD-90-30	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2525-D5	2	111.2			25000	0.75	15.12655598	10-20 knot	5.2-10.3	OK
24	MD-90-30ER	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2528-D5	2	124.5			28000	0.75	16.9417427	10-20 knot	5.2-10.3	OK
25	B707-120B	86300	190000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	16.25717402	10-20 knot	5.2-10.3	OK
26	B707-320	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	14.92546934	10-20 knot	5.2-10.3	OK
27	B707-420	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	14.92546934	10-20 knot	5.2-10.3	OK
28	B707-320B	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	14.92546934	10-20 knot	5.2-10.3	OK
29	B707-320C	112100	247000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	12.51555859	10-20 knot	5.2-10.3	OK
30	B717-200	49898	110000	2 Turbofan Engines	Rolls-Royce BR700-715C1-30	2	95.3			21430	0.75	16.73756905	10-20 knot	5.2-10.3	OK
31	B720	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3C-7	4	53.4			12000	0.75	11.76514983	10-20 knot	5.2-10.3	OK
32	B720B	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3D-1	4	75.62			17000	0.75	16.6672956	10-20 knot	5.2-10.3	OK
33	B727-100	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3			14500	0.75	13.10111715	10-20 knot	5.2-10.3	OK
34	B727-100C	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3			14500	0.75	13.10111715	10-20 knot	5.2-10.3	OK
35	B727-200	73100	161000	3 Turbofan Engines	Pratt & Whitney JT8D-17	3	71.2			16000	0.75	12.79520399	10-20 knot	5.2-10.3	OK
36	B737-100	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3			14500	0.75	12.58394987	10-20 knot	5.2-10.3	OK
37	B737-200	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	13.34659549	10-20 knot	5.2-10.3	OK
38	B737-200-Convertible-Ex	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	13.34659549	10-20 knot	5.2-10.3	OK
39	B737-200 Advanced	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	12.847755	10-20 knot	5.2-10.3	OK
40	B737-200C/-200QC	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	12.847755	10-20 knot	5.2-10.3	OK
41	B737-300	52889	116000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9			22000	0.75	16.21103243	10-20 knot	5.2-10.3	OK
42	B737-400	56245	124000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9			22000	0.75	15.24376023	10-20 knot	5.2-10.3	OK
43	B737-500	49895	110000	2 Turbofan Engines	CFM Intl. CFM56-3C1	2	104.5			23500	0.75	18.35541402	10-20 knot	5.2-10.3	OK
44	B737-600	51936	121500	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	16.50849688	10-20 knot	5.2-10.3	OK
45	B737-700/-Winglets/-700C	58604	129200	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	14.63014972	10-20 knot	5.2-10.3	OK
46	B737-800/-800 Winglets	66361	146300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	16.03256741	10-20 knot	5.2-10.3	OK
47	B737-900/-900 Winglets	66814	147300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	15.92386634	10-20 knot	5.2-10.3	OK
48	B737-900ER/-900ER Winglets	71350	157300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	14.91152356	10-20 knot	5.2-10.3	OK
49	B737-BBJ	60781	134000	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	14.10613998	10-20 knot	5.2-10.3	OK
50	B737-BBJ2	66360	146300	2 Turbofan Engines	CFM Intl. CFM56-7B26	2	117.4			26400	0.75	15.50425487	10-20 knot	5.2-10.3	OK
51	B737 Max-7	66043	145600	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	16.52283584	10-20 knot	5.2-10.3	OK
52	B737 Max-8/-200-/-BBJ8	69308	152800	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	15.74446885	10-20 knot	5.2-10.3	OK

53	B737 Max-9	74343	163900	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	14.67814921	10-20 knot	5.2-10.3	OK
54	B747-100/-100B	265300	585000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	14.10221503	10-20 knot	5.2-10.3	OK
55	B747-100SF	255800	584000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	14.62594858	10-20 knot	5.2-10.3	OK
56	B747-100B SR	273500	564000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	13.67940639	10-20 knot	5.2-10.3	OK
57	B747-200B/-200B Combi	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	13.6378476	10-20 knot	5.2-10.3	OK
58	B747-200C	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	13.6378476	10-20 knot	5.2-10.3	OK
59	B747-200F	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	13.6378476	10-20 knot	5.2-10.3	OK
60	B747-300	255800	564000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	16.14948489	10-20 knot	5.2-10.3	OK
61	B747-300SR	242630	535000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	17.02608183	10-20 knot	5.2-10.3	OK
62	B747-300	260320	574000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	15.86907743	10-20 knot	5.2-10.3	OK
63	B747-300 Combi	274380	605000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	15.05590143	10-20 knot	5.2-10.3	OK
64	B747-SP	204100	450000	4 Turbofan Engines	Pratt & Whitney JT9D-7FW	4	218.4			49100	0.75	18.75088768	10-20 knot	5.2-10.3	OK
65	B747-400 (CF6-80C2B1 engines)	285764	630000	4 Turbofan Engines	General Electric CF6-80C2B1F	4	254.3			57160	0.75	15.59078738	10-20 knot	5.2-10.3	OK
66	B747-8	312072	688000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8			66498	0.75	16.60875675	10-20 knot	5.2-10.3	OK
67	B747-8F	345184	761000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8			66498	0.75	15.01555094	10-20 knot	5.2-10.3	OK
68	B757-200/-200PF	92250	210000	2 Turbofan Engines	Rolls-Royce RB.211-535E4-37	2	189			42500	0.75	17.95460705	10-20 knot	5.2-10.3	OK
69	B757-300	101610	224000	2 Turbofan Engines	Pratt & Whitney PW2043	2	189.49			42600	0.75	16.33903854	10-20 knot	5.2-10.3	OK
70	B767-200	123377	272000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5			48000	0.75	15.16213576	10-20 knot	5.2-10.3	OK
71	B767-200ER	136078	300000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5			48000	0.75	13.74696	10-20 knot	5.2-10.3	OK
72	B767-300	136078	300000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	17.18370001	10-20 knot	5.2-10.3	OK
73	B767-300ER	145150	320000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	16.10970396	10-20 knot	5.2-10.3	OK
74	B767-300ER Freighter	147871	326000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	15.81326649	10-20 knot	5.2-10.3	OK
75	B767-400ER	158757	350000	2 Turbofan Engines	General Electric CF6-80C2B8F	2	282.46			63500	0.75	15.58813618	10-20 knot	5.2-10.3	OK
76	B777-200 (GE engines)	208700	460000	2 Turbofan Engines	General Electric GE90-94B	2	416.798			93700	0.75	17.49727797	10-20 knot	5.2-10.3	OK
77	B777-200 (P & W engines/RR engines)	206350	455000	2 Turbofan Engines	Pratt & Whitney PW4077	2	343.4			77200	0.75	14.58029048	10-20 knot	5.2-10.3	OK
78	B777-300	237680	524000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	18.16116306	10-20 knot	5.2-10.3	OK
79	B777-200LR	223168	492000	2 Turbofan Engines	General Electric GE90-115B	2	513.9			115540	0.75	20.17686979	10-20 knot	5.2-10.3	OK
80	B777-300ER	251290	554000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	17.17754481	10-20 knot	5.2-10.3	OK
81	B777-F	260816	575000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	16.55015503	10-20 knot	5.2-10.3	OK
82	B777-9	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5			78129	0.75	11.43570516	10-20 knot	5.2-10.3	OK
83	B777-9X/-8X	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5			78129	0.75	11.43570516	10-20 knot	5.2-10.3	OK
84	B787-8	172365	380000	2 Turbofan Engines	General Electric GEnx-1B70	2	321.6			72300	0.75	16.3471694	10-20 knot	5.2-10.3	OK
85	B787-9	192778	425000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6			78129	0.75	15.79458229	10-20 knot	5.2-10.3	OK
86	B787-10	201848	445000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6			78129	0.75	15.08485585	10-20 knot	5.2-10.3	OK
87	A300B2-100	127500	281089	2 Turbofan Engines	General Electric CF6-50C	2	226.859			51000	0.75	15.58882353	10-20 knot	5.2-10.3	OK
88	A300B2-200	130000	286600	2 Turbofan Engines	General Electric CF6-50C2	2	233.53			52500	0.75	15.73871606	10-20 knot	5.2-10.3	OK
89	A300B4-100	133000	293214	2 Turbofan Engines	General Electric CF6-50C2	2	233.53			52500	0.75	15.38370743	10-20 knot	5.2-10.3	OK
90	A300B4-600	134000	295419	2 Turbofan Engines	Pratt & Whitney PW4158	2	258			58000	0.75	16.86850307	10-20 knot	5.2-10.3	OK
91	A300C4-600	136000	299828	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3			60100	0.75	17.22221129	10-20 knot	5.2-10.3	OK
92	A300F4-200	136000	299828	2 Turbofan Engines	General Electric CF6-50C1	2	233.53			52500	0.75	15.04436094	10-20 knot	5.2-10.3	OK
93	A300F4-600	140000	308646	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3			60100	0.75	16.73014811	10-20 knot	5.2-10.3	OK
94	A310-200	118500	261247	2 Turbofan Engines	General Electric CF6-80A2	2	222.411			50000	0.75	16.44390668	10-20 knot	5.2-10.3	OK
95	A310-300	123000	271168	2 Turbofan Engines	Pratt & Whitney PW4152	2	232.197			52200	0.75	16.53936155	10-20 knot	5.2-10.3	OK
96	A318-100	57500	125766	2 Turbofan Engines	Pratt & Whitney PW6122	2	97.86			22000	0.75	14.91104859	10-20 knot	5.2-10.3	OK
97	A319-100	61000	134482	2 Turbofan Engines	CFM Intl. CFM56-5B5	2	97.86			22000	0.75	14.05549662	10-20 knot	5.2-10.3	OK
98	A319-Neo	62800	138450	2 Turbofan Engines	IAE International Aero Engines V2524-A5	2	104.533			23500	0.75	14.58349335	10-20 knot	5.2-10.3	OK
99	A320-200	64500	142198	2 Turbofan Engines	CFM Intl. CFM56-5A1	2	111.206			25000	0.75	15.10544916	10-20 knot	5.2-10.3	OK
100	A320-Neo	66300	146166	2 Turbofan Engines	IAE International Aero Engines V2527-A5	2	117.878			26500	0.75	15.57706725	10-20 knot	5.2-10.3	OK
101	A321-100	75500	166449	2 Turbofan Engines	FM Intl. CFM56-5B1/P	2	133.447			30000	0.75	15.48558629	10-20 knot	5.2-10.3	OK
102	A321-200	77800	171520	2 Turbofan Engines	FM Intl. CFM56-5B3/2P	2	142.3			32000	0.75	16.02963859	10-20 knot	5.2-10.3	OK
103	A321-Neo	79200	174606	2 Turbofan Engines	IAE International Aero Engines V2533-A5	2	146.791			33000	0.75	16.23835784	10-20 knot	5.2-10.3	OK
104	A330-200	180000	396832	2 Turbofan Engines	General Electric CF6-80E1A2	2	300.255			67500	0.75	14.61452206	10-20 knot	5.2-10.3	OK
105	A330-200F	182000	401241	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	14.68946833	10-20 knot	5.2-10.3	OK

106	A330-300	187000	412264	2 Turbofan Engines	Pratt & Whitney PW4164	2	284.686			64000	0.75	13.33803083	10-20 knot	5.2-10.3	OK
107	A330-800	186000	410060	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	14.37356578	10-20 knot	5.2-10.3	OK
108	A330-900	191000	421083	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	13.99729443	10-20 knot	5.2-10.3	OK
109	A340-200	185000	407855	4 Turbofan Engines	CFM Intl. CFM56-5C2	4	138.785			31200	0.75	13.14517011	10-20 knot	5.2-10.3	OK
110	A340-300	192000	410060	4 Turbofan Engines	CFM Intl. CFM56-5C4	4	151.2			34000	0.75	13.80260417	10-20 knot	5.2-10.3	OK
111	A340-500	246000	542337	4 Turbofan Engines	Rolls-Royce Trent 553-61	4	235.756			53000	0.75	16.79283835	10-20 knot	5.2-10.3	OK
112	A340-600	265000	584225	4 Turbofan Engines	Rolls-Royce Trent 556-61	4	249.1			56000	0.75	16.47120977	10-20 knot	5.2-10.3	OK
113	A350-900	205000	451948	2 Turbofan Engines	Trent XWB-84	2	373			84000	0.75	15.96903874	10-20 knot	5.2-10.3	OK
114	A350-1000	233000	513677	2 Turbofan Engines	Trent XWB-97	2	431.5			97000	0.75	16.22441934	10-20 knot	5.2-10.3	OK
115	A380-800	395000	870826	4 Turbofan engines	Engine Alliance GP7270	4	311.376			70000	0.75	13.81288161	10-20 knot	5.2-10.3	OK
116	BAE146-100A	35153	77499	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803			6700	0.75	14.85579007	10-20 knot	5.2-10.3	OK
117	BAE146-200	36741	81000	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041			6970	0.75	14.78649193	10-20 knot	5.2-10.3	OK
118	BAE146-300	38329	84501	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617			7500	0.75	15.25166016	10-20 knot	5.2-10.3	OK
119	Avro RJ70	37875	83500	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803			6700	0.75	13.78813434	10-20 knot	5.2-10.3	OK
120	Avro RJ85	38556	85001	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041			6970	0.75	14.09042691	10-20 knot	5.2-10.3	OK
121	Avro RJ100	40143	88500	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617			7500	0.75	14.56246126	10-20 knot	5.2-10.3	OK
122	Bombardier Challenger 300	15309	33750	2 Turbofan engines	Honeywell HTF 7000 (AS907)	2	28.9134			6500	0.75	16.54730172	10-20 knot	5.2-10.3	OK
123	Bombardier CL-600	16329	36000	2 Turbofan enginess	Avco Lycoming ALF502L	2	33.3617			7500	0.75	17.89972541	10-20 knot	5.2-10.3	OK
124	Bombardier CL-601-3A	16329	36000	2 Turbofan enginess	General Electric CF34-3A	2	41			9220	0.75	22.00472911	10-20 knot	5.2-10.3	OK
125	Bombardier CL-601-3R	16329	36000	2 Turbofan enginess	General Electric CF34-3A	2	41			9220	0.75	22.00472911	10-20 knot	5.2-10.3	OK
126	Bombardier CL-604	17237	38000	2 Turbofan enginess	General Electric CF34-3B	2	41			9220	0.75	20.84658547	10-20 knot	5.2-10.3	OK
127	Bombardier CL-605	17237	38000	2 Turbofan enginess	General Electric CF34-3B1	2	41			9220	0.75	20.84658547	10-20 knot	5.2-10.3	OK
128	LEARJET-24D	5389	11880	2 Turbojet engines	General Electric CJ610-6	2	13.1			2950	0.75	21.33502625	10-20 knot	5.2-10.3	OK
129	LEARJET-25D	6033	13300	2 Turbojet engines	General Electric CJ610-8A	2	13.1			2950	0.75	19.05715127	10-20 knot	5.2-10.3	OK
130	LEARJET-31A	7257	16000	2 Turbofan engines	Garrett TFE731-2	2	15.6			3500	0.75	18.79471169	10-20 knot	5.2-10.3	OK
131	LEARJET-35A/-36A	6940	15300	2 Turbofan engines	Garrett TFE731-2-2B	2	15.6			3500	0.75	19.65460046	10-20 knot	5.2-10.3	OK
132	LEARJET-40	8709	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20AR	2	15.6			3500	0.75	15.66225974	10-20 knot	5.2-10.3	OK
133	LEARJET-45X	8709	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20BR	2	15.6			3500	0.75	15.66225974	10-20 knot	5.2-10.3	OK
134	LEARJET-55	8165	18000	2 Turbofan engines	Garrett TFE731-3A-2B	2	16.236			3650	0.75	17.4223994	10-20 knot	5.2-10.3	OK
135	Bombardier CRJ-100/-200	20276	44700	2 Turbofan engines	General Electric CF34-3A1	2	41			9220	0.75	17.72156157	10-20 knot	5.2-10.3	OK
136	Bombardier CRJ-200LR	21319	47000	2 Turbofan engines	General Electric CF34-3B1	2	41			9220	0.75	16.85456083	10-20 knot	5.2-10.3	OK
137	Bombardier CRJ700	30390	67000	2 Turbofan engines	General Electric CF34-8C1	2	60.9			13700	0.75	17.56884521	10-20 knot	5.2-10.3	OK
138	Bombardier CRJ1000	36968	81500	2 Turbofan engines	General Electric CF34-8C5A1	2	64.4992			14500	0.75	15.28605423	10-20 knot	5.2-10.3	OK
139	Dornier 328 Jet/-300	14390	31724	2 Turbofan engines	Pratt & Whitney Canada PW306B	2	26.9			6050	0.75	16.385056	10-20 knot	5.2-10.3	OK
140	EMB135BJ	18500	40785	2 Turbofan engines	Allison / Rolls-Royce AE3007A1/3	2	32.0272			7200	0.75	15.16750397	10-20 knot	5.2-10.3	OK
141	ERJ190-100LR	43000	94799	2 Turbofan engines	General Electric CF34-10E5	2	82.3			18500	0.75	16.76704856	10-20 knot	5.2-10.3	OK
142	F-28 Fellowship	29030	64000	2 Turbofan engines	Rolls-Royce RB.183 Spey Mk.555-15P	2	44.0374			9900	0.75	13.29050576	10-20 knot	5.2-10.3	OK
143	F-70	36740	81000	2 Turbofan engines	Rolls-Royce Tay 620-15	2	616			13850	0.75	14.69142664	10-20 knot	5.2-10.3	OK
144	F-100	38780	88000	2 Turbofan engines	Rolls-Royce Tay 650-15	2	672			15100	0.75	15.17478309	10-20 knot	5.2-10.3	OK
145	Cessna Citation Sovereign	12508	27575	2 Turbofan engines	Pratt & Whitney Canada PW306C	2	25.2926			5686	0.75	17.7162717	10-20 knot	5.2-10.3	OK
146	Cessna Citation Longitude	15195	33500	2 Turbofan engines	Honeywell HTF7700L	2	33.81			7600	0.75	19.4924414	10-20 knot	5.2-10.3	OK
147	Cessna Citation CJ1+	4491	9900	2 Turbofan engines	Williams / Rolls-Royce FJ44-1AP	2	8.5			1900	0.75	16.48944402	10-20 knot	5.2-10.3	OK
148	Cessna Citation CJ1	4445	9800	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5			1900	0.75	16.65770365	10-20 knot	5.2-10.3	OK
149	Cessna Citation CJ2+	5228	11525	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447			3000	0.75	22.36494976	10-20 knot	5.2-10.3	OK
150	Cessna Citation CJ2	5216	11500	2 Turbofan engines	Williams / Rolls-Royce FJ44-2C	2	10.6757			2400	0.75	17.93085537	10-20 knot	5.2-10.3	OK
151	Cessna Citation CJ3	5783	12750	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447			3000	0.75	20.21616047	10-20 knot	5.2-10.3	OK
152	Cessna Citation Encore	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	20.46786497	10-20 knot	5.2-10.3	OK
153	Cessna Citation Encore+	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	20.46786497	10-20 knot	5.2-10.3	OK
154	Cessna Citation II/-IISP	6123	13500	2 Turbofan engines	Pratt & Whitney Canada JT15D-4	2	11.1			2500	0.75	15.91086704	10-20 knot	5.2-10.3	OK
155	Cessna Citation I/-ISP	5148	11350	2 Turbofan engines	Pratt & Whitney Canada JT15D-1A	2	9.8			2200	0.75	16.65384144	10-20 knot	5.2-10.3	OK
156	Cessna Citation Jet	4400	9700	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5			1900	0.75	16.82943255	10-20 knot	5.2-10.3	OK
157	Cessna Citation Mustang	3629	8000	2 Turbofan engines	Pratt & Whitney Canada PW615F	2	6.0051			1350	0.75	14.49877759	10-20 knot	5.2-10.3	OK
158	Cessna Citation S/II	6350	14000	2 Turbofan engines	Pratt & Whitney Canada JT15D-4B	2	11.1			2500	0.75	15.34262178	10-20 knot	5.2-10.3	OK
159	Cessna Citation Ultra	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	20.46786497	10-20 knot	5.2-10.3	OK
160	Cessna Citation V	6895	15200	2 Turbofan engines	Pratt & Whitney Canada JT15D-5A	2	12.8998			2900	0.75	16.39238012	10-20 knot	5.2-10.3	OK
161	Cessna Citation Excel	8482	18700	2 Turbofan engines	Pratt & Whitney Canada PW545A	2	16.8321			3784	0.75	17.385898	10-20 knot	5.2-10.3	OK
162	Cessna Citation III	9072	20000	2 Turbofan engines	Garrett TFE731-3-100S	2	16.2			3650	0.75	15.68015946	10-20 knot	5.2-10.3	OK
163	Cessna Citation VI	9072	20000	2 Turbofan engines	Garrett TFE731-3B-100	2	16.2			3650	0.75	15.68015946	10-20 knot	5.2-10.3	OK
164	Cessna Citation VII	9072	20000	2 Turbofan engines	Garrett TFE731-4	2	18.1487			4080	0.75	17.52741113	10-20 knot	5.2-10.3	OK
165	Cessna Citation XLS	8482	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C	2	28.6554			6442	0.75	29.59829676	10-20 knot	5.2-10.3	OK
166	Cessna Citation XLS+	8482	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C1	2	30.0878			6764	0.75	31.07775214	10-20 knot	5.2-10.3	OK

c. Gradien 1,5° (g = 2,6 %)

No	Aircraft	MLW		Propulsion	engines	n	Power engines				Engine	V taxiing Calculate	V taxiing range (knots)	V taxiing range (m/s)	Control
		Kg	Lbs			Engine	kN	kW	hp	lbf	efficiency				
1	DC-9-15	37059	81700	2 Turbofan Engines	Pratt & Whitney JT8D-7	2	62.3			14000	0.75	14.72270767	10-20 knot	5.2-10.3	OK
2	DC-9-21	43227	95300	2 Turbofan Engines	Pratt & Whitney JT8D-11	2	66.7			15000	0.75	13.52351267	10-20 knot	5.2-10.3	OK
3	DC-9-32	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-15	2	68.95			15500	0.75	13.45180848	10-20 knot	5.2-10.3	OK
4	DC-9-33F	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3			14500	0.75	12.58394987	10-20 knot	5.2-10.3	OK
5	DC-9-41	46266	102000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	13.47756325	10-20 knot	5.2-10.3	OK
6	DC-9-51	49895	110000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	12.49730316	10-20 knot	5.2-10.3	OK
7	DC-9-80	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	10.73980264	10-20 knot	5.2-10.3	OK
8	DC-8-61	108862	240000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	12.88782236	10-20 knot	5.2-10.3	OK
9	DC-8-63	117027	258000	4 Turbofan Engines	Pratt & Whitney JT3D-7	4	84.5			19000	0.75	12.65467145	10-20 knot	5.2-10.3	OK
10	DC-10-10	164881	363500	3 Turbofan Engines	General Electric CF6-6D	3	185			41500	0.75	14.71370662	10-20 knot	5.2-10.3	OK
11	DC-10-30	182798	403000	3 Turbofan Engines	General Electric CF6-50C	3	226			50800	0.75	16.24564209	10-20 knot	5.2-10.3	OK
12	DC-10-40	182798	403000	3 Turbofan Engines	Pratt and Whitney JT9D-20	3	219.7			49400	0.75	15.79792754	10-20 knot	5.2-10.3	OK
13	MD-11 -Passengger	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	18.18947836	10-20 knot	5.2-10.3	OK
14	MD-11 -Passengger-ER	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	18.18947836	10-20 knot	5.2-10.3	OK
15	MD-11-Combi	207749	458000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	17.07744141	10-20 knot	5.2-10.3	OK
16	MD-11-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	16.58852667	10-20 knot	5.2-10.3	OK
17	MD-11-Convertible-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	16.58852667	10-20 knot	5.2-10.3	OK
18	MD-81	58061	128000	2 Turbofan Engines	Pratt & Whitney JT8D-209	2	82.3			18500	0.75	12.41768292	10-20 knot	5.2-10.3	OK
19	MD-82	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217A	2	89			20000	0.75	13.21826066	10-20 knot	5.2-10.3	OK
20	MD-83	63276	139500	2 Turbofan Engines	Pratt & Whitney JT8D-219	2	93.4			21000	0.75	12.93402294	10-20 knot	5.2-10.3	OK
21	MD-87	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89			20000	0.75	13.4247533	10-20 knot	5.2-10.3	OK
22	MD-88	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89			20000	0.75	13.21826066	10-20 knot	5.2-10.3	OK
23	MD-90-30	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2525-D5	2	111.2			25000	0.75	15.12655598	10-20 knot	5.2-10.3	OK
24	MD-90-30ER	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2528-D5	2	124.5			28000	0.75	16.9417427	10-20 knot	5.2-10.3	OK
25	B707-120B	86300	190000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	16.25717402	10-20 knot	5.2-10.3	OK
26	B707-320	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	14.92546934	10-20 knot	5.2-10.3	OK
27	B707-420	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	14.92546934	10-20 knot	5.2-10.3	OK
28	B707-320B	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	14.92546934	10-20 knot	5.2-10.3	OK
29	B707-320C	112100	247000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	12.51555859	10-20 knot	5.2-10.3	OK
30	B717-200	49898	110000	2 Turbofan Engines	Rolls-Royce BR700-715C1-30	2	95.3			21430	0.75	16.73756905	10-20 knot	5.2-10.3	OK
31	B720	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3C-7	4	53.4			12000	0.75	11.76514983	10-20 knot	5.2-10.3	OK
32	B720B	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3D-1	4	75.62			17000	0.75	16.6672956	10-20 knot	5.2-10.3	OK
33	B727-100	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3			14500	0.75	13.10111715	10-20 knot	5.2-10.3	OK
34	B727-100C	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3			14500	0.75	13.10111715	10-20 knot	5.2-10.3	OK
35	B727-200	73100	161000	3 Turbofan Engines	Pratt & Whitney JT8D-17	3	71.2			16000	0.75	12.79520399	10-20 knot	5.2-10.3	OK
36	B737-100	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3			14500	0.75	12.58394987	10-20 knot	5.2-10.3	OK
37	B737-200	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	13.34659549	10-20 knot	5.2-10.3	OK
38	B737-200-Convertible-Ex	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	13.34659549	10-20 knot	5.2-10.3	OK
39	B737-200 Advanced	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	12.847755	10-20 knot	5.2-10.3	OK
40	B737-200C/-200QC	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	12.847755	10-20 knot	5.2-10.3	OK
41	B737-300	52889	116000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9			22000	0.75	16.21103243	10-20 knot	5.2-10.3	OK
42	B737-400	56245	124000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9			22000	0.75	15.24376023	10-20 knot	5.2-10.3	OK
43	B737-500	49895	110000	2 Turbofan Engines	CFM Intl. CFM56-3C1	2	104.5			23500	0.75	18.35541402	10-20 knot	5.2-10.3	OK
44	B737-600	51936	121500	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	16.50849688	10-20 knot	5.2-10.3	OK
45	B737-700/-Winglets/-700C	58604	129200	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	14.63014972	10-20 knot	5.2-10.3	OK
46	B737-800/-800 Winglets	66361	146300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	16.03256741	10-20 knot	5.2-10.3	OK
47	B737-900/-900 Winglets	66814	147300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	15.92386634	10-20 knot	5.2-10.3	OK
48	B737-900ER/-900ER Winglets	71350	157300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	14.91152356	10-20 knot	5.2-10.3	OK
49	B737-BBJ	60781	134000	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	14.10613998	10-20 knot	5.2-10.3	OK
50	B737-BBJ2	66360	146300	2 Turbofan Engines	CFM Intl. CFM56-7B26	2	117.4			26400	0.75	15.50425487	10-20 knot	5.2-10.3	OK
51	B737 Max-7	66043	145600	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	16.52283584	10-20 knot	5.2-10.3	OK
52	B737 Max-8/-200-/-BBJ8	69308	152800	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	15.74446885	10-20 knot	5.2-10.3	OK

53	B737 Max-9	74343	163900	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	14.67814921	10-20 knot	5.2-10.3	OK
54	B747-100/-100B	265300	585000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	14.10221503	10-20 knot	5.2-10.3	OK
55	B747-100SF	255800	584000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	14.62594858	10-20 knot	5.2-10.3	OK
56	B747-100B SR	273500	564000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	13.67940639	10-20 knot	5.2-10.3	OK
57	B747-200B/-200B Combi	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	13.6378476	10-20 knot	5.2-10.3	OK
58	B747-200C	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	13.6378476	10-20 knot	5.2-10.3	OK
59	B747-200F	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	13.6378476	10-20 knot	5.2-10.3	OK
60	B747-300	255800	564000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	16.14948489	10-20 knot	5.2-10.3	OK
61	B747-300SR	242630	535000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	17.02608183	10-20 knot	5.2-10.3	OK
62	B747-300	260320	574000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	15.86907743	10-20 knot	5.2-10.3	OK
63	B747-300 Combi	274380	605000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	15.05590143	10-20 knot	5.2-10.3	OK
64	B747-SP	204100	450000	4 Turbofan Engines	Pratt & Whitney JT9D-7FW	4	218.4			49100	0.75	18.75088768	10-20 knot	5.2-10.3	OK
65	B747-400 (CF6-80C2B1 engines)	285764	630000	4 Turbofan Engines	General Electric CF6-80C2B1F	4	254.3			57160	0.75	15.59078738	10-20 knot	5.2-10.3	OK
66	B747-8	312072	688000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8			66498	0.75	16.60875675	10-20 knot	5.2-10.3	OK
67	B747-8F	345184	761000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8			66498	0.75	15.01555094	10-20 knot	5.2-10.3	OK
68	B757-200/-200PF	92250	210000	2 Turbofan Engines	Rolls-Royce RB.211-535E4-37	2	189			42500	0.75	17.95460705	10-20 knot	5.2-10.3	OK
69	B757-300	101610	224000	2 Turbofan Engines	Pratt & Whitney PW2043	2	189.49			42600	0.75	16.33903854	10-20 knot	5.2-10.3	OK
70	B767-200	123377	272000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5			48000	0.75	15.16213576	10-20 knot	5.2-10.3	OK
71	B767-200ER	136078	300000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5			48000	0.75	13.74696	10-20 knot	5.2-10.3	OK
72	B767-300	136078	300000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	17.18370001	10-20 knot	5.2-10.3	OK
73	B767-300ER	145150	320000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	16.10970396	10-20 knot	5.2-10.3	OK
74	B767-300ER Freighter	147871	326000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	15.81326649	10-20 knot	5.2-10.3	OK
75	B767-400ER	158757	350000	2 Turbofan Engines	General Electric CF6-80C2B8F	2	282.46			63500	0.75	15.58813618	10-20 knot	5.2-10.3	OK
76	B777-200 (GE engines)	208700	460000	2 Turbofan Engines	General Electric GE90-94B	2	416.798			93700	0.75	17.49727797	10-20 knot	5.2-10.3	OK
77	B777-200 (P & W engines/RR engines)	206350	455000	2 Turbofan Engines	Pratt & Whitney PW4077	2	343.4			77200	0.75	14.58029048	10-20 knot	5.2-10.3	OK
78	B777-300	237680	524000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	18.16116306	10-20 knot	5.2-10.3	OK
79	B777-200LR	223168	492000	2 Turbofan Engines	General Electric GE90-115B	2	513.9			115540	0.75	20.17686979	10-20 knot	5.2-10.3	OK
80	B777-300ER	251290	554000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	17.17754481	10-20 knot	5.2-10.3	OK
81	B777-F	260816	575000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	16.55015503	10-20 knot	5.2-10.3	OK
82	B777-9	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5			78129	0.75	11.43570516	10-20 knot	5.2-10.3	OK
83	B777-9X/-8X	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5			78129	0.75	11.43570516	10-20 knot	5.2-10.3	OK
84	B787-8	172365	380000	2 Turbofan Engines	General Electric GEnx-1B70	2	321.6			72300	0.75	16.3471694	10-20 knot	5.2-10.3	OK
85	B787-9	192778	425000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6			78129	0.75	15.79458229	10-20 knot	5.2-10.3	OK
86	B787-10	201848	445000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6			78129	0.75	15.08485585	10-20 knot	5.2-10.3	OK
87	A300B2-100	127500	281089	2 Turbofan Engines	General Electric CF6-50C	2	226.859			51000	0.75	15.58882353	10-20 knot	5.2-10.3	OK
88	A300B2-200	130000	286600	2 Turbofan Engines	General Electric CF6-50C2	2	233.53			52500	0.75	15.73871606	10-20 knot	5.2-10.3	OK
89	A300B4-100	133000	293214	2 Turbofan Engines	General Electric CF6-50C2	2	233.53			52500	0.75	15.38370743	10-20 knot	5.2-10.3	OK
90	A300B4-600	134000	295419	2 Turbofan Engines	Pratt & Whitney PW4158	2	258			58000	0.75	16.86850307	10-20 knot	5.2-10.3	OK
91	A300C4-600	136000	299828	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3			60100	0.75	17.22221129	10-20 knot	5.2-10.3	OK
92	A300F4-200	136000	299828	2 Turbofan Engines	General Electric CF6-50C1	2	233.53			52500	0.75	15.04436094	10-20 knot	5.2-10.3	OK
93	A300F4-600	140000	308646	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3			60100	0.75	16.73014811	10-20 knot	5.2-10.3	OK
94	A310-200	118500	261247	2 Turbofan Engines	General Electric CF6-80A2	2	222.411			50000	0.75	16.44390668	10-20 knot	5.2-10.3	OK
95	A310-300	123000	271168	2 Turbofan Engines	Pratt & Whitney PW4152	2	232.197			52200	0.75	16.53936155	10-20 knot	5.2-10.3	OK
96	A318-100	57500	125766	2 Turbofan Engines	Pratt & Whitney PW6122	2	97.86			22000	0.75	14.91104859	10-20 knot	5.2-10.3	OK
97	A319-100	61000	134482	2 Turbofan Engines	CFM Intl. CFM56-5B5	2	97.86			22000	0.75	14.05549662	10-20 knot	5.2-10.3	OK
98	A319-Neo	62800	138450	2 Turbofan Engines	IAE International Aero Engines V2524-A5	2	104.533			23500	0.75	14.58349335	10-20 knot	5.2-10.3	OK
99	A320-200	64500	142198	2 Turbofan Engines	CFM Intl. CFM56-5A1	2	111.206			25000	0.75	15.10544916	10-20 knot	5.2-10.3	OK
100	A320-Neo	66300	146166	2 Turbofan Engines	IAE International Aero Engines V2527-A5	2	117.878			26500	0.75	15.57706725	10-20 knot	5.2-10.3	OK
101	A321-100	75500	166449	2 Turbofan Engines	FM Intl. CFM56-5B1/P	2	133.447			30000	0.75	15.48558629	10-20 knot	5.2-10.3	OK
102	A321-200	77800	171520	2 Turbofan Engines	FM Intl. CFM56-5B3/2P	2	142.3			32000	0.75	16.02963859	10-20 knot	5.2-10.3	OK
103	A321-Neo	79200	174606	2 Turbofan Engines	IAE International Aero Engines V2533-A5	2	146.791			33000	0.75	16.23835784	10-20 knot	5.2-10.3	OK
104	A330-200	180000	396832	2 Turbofan Engines	General Electric CF6-80E1A2	2	300.255			67500	0.75	14.61452206	10-20 knot	5.2-10.3	OK
105	A330-200F	182000	401241	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	14.68946833	10-20 knot	5.2-10.3	OK

106	A330-300	187000	412264	2 Turbofan Engines	Pratt & Whitney PW4164	2	284.686			64000	0.75	13.33803083	10-20 knot	5.2-10.3	OK
107	A330-800	186000	410060	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	14.37356578	10-20 knot	5.2-10.3	OK
108	A330-900	191000	421083	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	13.99729443	10-20 knot	5.2-10.3	OK
109	A340-200	185000	407855	4 Turbofan Engines	CFM Intl. CFM56-5C2	4	138.785			31200	0.75	13.14517011	10-20 knot	5.2-10.3	OK
110	A340-300	192000	410060	4 Turbofan Engines	CFM Intl. CFM56-5C4	4	151.2			34000	0.75	13.80260417	10-20 knot	5.2-10.3	OK
111	A340-500	246000	542337	4 Turbofan Engines	Rolls-Royce Trent 553-61	4	235.756			53000	0.75	16.79283835	10-20 knot	5.2-10.3	OK
112	A340-600	265000	584225	4 Turbofan Engines	Rolls-Royce Trent 556-61	4	249.1			56000	0.75	16.47120977	10-20 knot	5.2-10.3	OK
113	A350-900	205000	451948	2 Turbofan Engines	Trent XWB-84	2	373			84000	0.75	15.96903874	10-20 knot	5.2-10.3	OK
114	A350-1000	233000	513677	2 Turbofan Engines	Trent XWB-97	2	431.5			97000	0.75	16.22441934	10-20 knot	5.2-10.3	OK
115	A380-800	395000	870826	4 Turbofan engines	Engine Alliance GP7270	4	311.376			70000	0.75	13.81288161	10-20 knot	5.2-10.3	OK
116	BAE146-100A	35153	77499	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803			6700	0.75	14.85579007	10-20 knot	5.2-10.3	OK
117	BAE146-200	36741	81000	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041			6970	0.75	14.78649193	10-20 knot	5.2-10.3	OK
118	BAE146-300	38329	84501	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617			7500	0.75	15.25166016	10-20 knot	5.2-10.3	OK
119	Avro RJ70	37875	83500	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803			6700	0.75	13.78813434	10-20 knot	5.2-10.3	OK
120	Avro RJ85	38556	85001	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041			6970	0.75	14.09042691	10-20 knot	5.2-10.3	OK
121	Avro RJ100	40143	88500	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617			7500	0.75	14.56246126	10-20 knot	5.2-10.3	OK
122	Bombardier Challenger 300	15309	33750	2 Turbofan engines	Honeywell HTF 7000 (AS907)	2	28.9134			6500	0.75	16.54730172	10-20 knot	5.2-10.3	OK
123	Bombardier CL-600	16329	36000	2 Turbofan enginess	Avco Lycoming ALF502L	2	33.3617			7500	0.75	17.89972541	10-20 knot	5.2-10.3	OK
124	Bombardier CL-601-3A	16329	36000	2 Turbofan enginess	General Electric CF34-3A	2	41			9220	0.75	22.00472911	10-20 knot	5.2-10.3	OK
125	Bombardier CL-601-3R	16329	36000	2 Turbofan enginess	General Electric CF34-3A	2	41			9220	0.75	22.00472911	10-20 knot	5.2-10.3	OK
126	Bombardier CL-604	17237	38000	2 Turbofan enginess	General Electric CF34-3B	2	41			9220	0.75	20.84658547	10-20 knot	5.2-10.3	OK
127	Bombardier CL-605	17237	38000	2 Turbofan enginess	General Electric CF34-3B1	2	41			9220	0.75	20.84658547	10-20 knot	5.2-10.3	OK
128	LEARJET-24D	5389	11880	2 Turbojet engines	General Electric CJ610-6	2	13.1			2950	0.75	21.33502625	10-20 knot	5.2-10.3	OK
129	LEARJET-25D	6033	13300	2 Turbojet engines	General Electric CJ610-8A	2	13.1			2950	0.75	19.05715127	10-20 knot	5.2-10.3	OK
130	LEARJET-31A	7257	16000	2 Turbofan engines	Garrett TFE731-2	2	15.6			3500	0.75	18.79471169	10-20 knot	5.2-10.3	OK
131	LEARJET-35A/-36A	6940	15300	2 Turbofan engines	Garrett TFE731-2-2B	2	15.6			3500	0.75	19.65460046	10-20 knot	5.2-10.3	OK
132	LEARJET-40	8709	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20AR	2	15.6			3500	0.75	15.66225974	10-20 knot	5.2-10.3	OK
133	LEARJET-45X	8709	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20BR	2	15.6			3500	0.75	15.66225974	10-20 knot	5.2-10.3	OK
134	LEARJET-55	8165	18000	2 Turbofan engines	Garrett TFE731-3A-2B	2	16.236			3650	0.75	17.4223994	10-20 knot	5.2-10.3	OK
135	Bombardier CRJ-100/-200	20276	44700	2 Turbofan engines	General Electric CF34-3A1	2	41			9220	0.75	17.72156157	10-20 knot	5.2-10.3	OK
136	Bombardier CRJ-200LR	21319	47000	2 Turbofan engines	General Electric CF34-3B1	2	41			9220	0.75	16.85456083	10-20 knot	5.2-10.3	OK
137	Bombardier CRJ700	30390	67000	2 Turbofan engines	General Electric CF34-8C1	2	60.9			13700	0.75	17.56884521	10-20 knot	5.2-10.3	OK
138	Bombardier CRJ1000	36968	81500	2 Turbofan engines	General Electric CF34-8C5A1	2	64.4992			14500	0.75	15.28605423	10-20 knot	5.2-10.3	OK
139	Dornier 328 Jet/-300	14390	31724	2 Turbofan engines	Pratt & Whitney Canada PW306B	2	26.9			6050	0.75	16.385056	10-20 knot	5.2-10.3	OK
140	EMB135BJ	18500	40785	2 Turbofan engines	Allison / Rolls-Royce AE3007A1/3	2	32.0272			7200	0.75	15.16750397	10-20 knot	5.2-10.3	OK
141	ERJ190-100LR	43000	94799	2 Turbofan engines	General Electric CF34-10E5	2	82.3			18500	0.75	16.76704856	10-20 knot	5.2-10.3	OK
142	F-28 Fellowship	29030	64000	2 Turbofan engines	Rolls-Royce RB.183 Spey Mk.555-15P	2	44.0374			9900	0.75	13.29050576	10-20 knot	5.2-10.3	OK
143	F-70	36740	81000	2 Turbofan engines	Rolls-Royce Tay 620-15	2	616			13850	0.75	14.69142664	10-20 knot	5.2-10.3	OK
144	F-100	38780	88000	2 Turbofan engines	Rolls-Royce Tay 650-15	2	672			15100	0.75	15.17478309	10-20 knot	5.2-10.3	OK
145	Cessna Citation Sovereign	12508	27575	2 Turbofan engines	Pratt & Whitney Canada PW306C	2	25.2926			5686	0.75	17.7162717	10-20 knot	5.2-10.3	OK
146	Cessna Citation Longitude	15195	33500	2 Turbofan engines	Honeywell HTF7700L	2	33.81			7600	0.75	19.4924414	10-20 knot	5.2-10.3	OK
147	Cessna Citation CJ1+	4491	9900	2 Turbofan engines	Williams / Rolls-Royce FJ44-1AP	2	8.5			1900	0.75	16.48944402	10-20 knot	5.2-10.3	OK
148	Cessna Citation CJ1	4445	9800	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5			1900	0.75	16.65770365	10-20 knot	5.2-10.3	OK
149	Cessna Citation CJ2+	5228	11525	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447			3000	0.75	22.36494976	10-20 knot	5.2-10.3	OK
150	Cessna Citation CJ2	5216	11500	2 Turbofan engines	Williams / Rolls-Royce FJ44-2C	2	10.6757			2400	0.75	17.93085537	10-20 knot	5.2-10.3	OK
151	Cessna Citation CJ3	5783	12750	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447			3000	0.75	20.21616047	10-20 knot	5.2-10.3	OK
152	Cessna Citation Encore	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	20.46786497	10-20 knot	5.2-10.3	OK
153	Cessna Citation Encore+	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	20.46786497	10-20 knot	5.2-10.3	OK
154	Cessna Citation II/-IISP	6123	13500	2 Turbofan engines	Pratt & Whitney Canada JT15D-4	2	11.1			2500	0.75	15.91086704	10-20 knot	5.2-10.3	OK
155	Cessna Citation I/-ISP	5148	11350	2 Turbofan engines	Pratt & Whitney Canada JT15D-1A	2	9.8			2200	0.75	16.65384144	10-20 knot	5.2-10.3	OK
156	Cessna Citation Jet	4400	9700	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5			1900	0.75	16.82943255	10-20 knot	5.2-10.3	OK
157	Cessna Citation Mustang	3629	8000	2 Turbofan engines	Pratt & Whitney Canada PW615F	2	6.0051			1350	0.75	14.49877759	10-20 knot	5.2-10.3	OK
158	Cessna Citation S/II	6350	14000	2 Turbofan engines	Pratt & Whitney Canada JT15D-4B	2	11.1			2500	0.75	15.34262178	10-20 knot	5.2-10.3	OK
159	Cessna Citation Ultra	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	20.46786497	10-20 knot	5.2-10.3	OK
160	Cessna Citation V	6895	15200	2 Turbofan engines	Pratt & Whitney Canada JT15D-5A	2	12.8998			2900	0.75	16.39238012	10-20 knot	5.2-10.3	OK
161	Cessna Citation Excel	8482	18700	2 Turbofan engines	Pratt & Whitney Canada PW545A	2	16.8321			3784	0.75	17.385898	10-20 knot	5.2-10.3	OK
162	Cessna Citation III	9072	20000	2 Turbofan engines	Garrett TFE731-3-100S	2	16.2			3650	0.75	15.68015946	10-20 knot	5.2-10.3	OK
163	Cessna Citation VI	9072	20000	2 Turbofan engines	Garrett TFE731-3B-100	2	16.2			3650	0.75	15.68015946	10-20 knot	5.2-10.3	OK
164	Cessna Citation VII	9072	20000	2 Turbofan engines	Garrett TFE731-4	2	18.1487			4080	0.75	17.52741113	10-20 knot	5.2-10.3	OK
165	Cessna Citation XLS	8482	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C	2	28.6554			6442	0.75	29.59829676	10-20 knot	5.2-10.3	OK
166	Cessna Citation XLS+	8482	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C1	2	30.0878			6764	0.75	31.07775214	10-20 knot	5.2-10.3	OK

d. Gradien 2° (g = 3,5 %)

No	Aircraft	MLW		Propulsion	engines	n	Power engines				Engine	V taxiing Calculate	V taxiing range	V taxiing range	Control
		Kg	Lbs			Engine	kN	kW	hp	lbf	efficiency		(knots)	(m/s)	
1	DC-9-15	37059	81700	2 Turbofan Engines	Pratt & Whitney JT8D-7	2	62.3			14000	0.75	7.362475175	10-20 knot	5.2-10.3	OK
2	DC-9-21	43227	95300	2 Turbofan Engines	Pratt & Whitney JT8D-11	2	66.7			15000	0.75	6.762786342	10-20 knot	5.2-10.3	OK
3	DC-9-32	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-15	2	68.95			15500	0.75	6.726928786	10-20 knot	5.2-10.3	OK
4	DC-9-33F	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3			14500	0.75	6.29293338	10-20 knot	5.2-10.3	OK
5	DC-9-41	46266	102000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	6.739808129	10-20 knot	5.2-10.3	OK
6	DC-9-51	49895	110000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	6.249603425	10-20 knot	5.2-10.3	OK
7	DC-9-80	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	5.370719306	10-20 knot	5.2-10.3	OK
8	DC-8-61	108862	240000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	6.444892768	10-20 knot	5.2-10.3	OK
9	DC-8-63	117027	258000	4 Turbofan Engines	Pratt & Whitney JT3D-7	4	84.5			19000	0.75	6.328299554	10-20 knot	5.2-10.3	OK
10	DC-10-10	164881	363500	3 Turbofan Engines	General Electric CF6-6D	3	185			41500	0.75	7.357973967	10-20 knot	5.2-10.3	OK
11	DC-10-30	182798	403000	3 Turbofan Engines	General Electric CF6-50C	3	226			50800	0.75	8.124058377	10-20 knot	5.2-10.3	OK
12	DC-10-40	182798	403000	3 Turbofan Engines	Pratt and Whitney JT9D-20	3	219.7			49400	0.75	7.900167005	10-20 knot	5.2-10.3	OK
13	MD-11 -Passengger	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	9.096124563	10-20 knot	5.2-10.3	OK
14	MD-11 -Passengger-ER	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	9.096124563	10-20 knot	5.2-10.3	OK
15	MD-11-Combi	207749	458000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	8.54002139	10-20 knot	5.2-10.3	OK
16	MD-11-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	8.295526782	10-20 knot	5.2-10.3	OK
17	MD-11-Convertible-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	8.295526782	10-20 knot	5.2-10.3	OK
18	MD-81	58061	128000	2 Turbofan Engines	Pratt & Whitney JT8D-209	2	82.3			18500	0.75	6.209787243	10-20 knot	5.2-10.3	OK
19	MD-82	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217A	2	89			20000	0.75	6.610137087	10-20 knot	5.2-10.3	OK
20	MD-83	63276	139500	2 Turbofan Engines	Pratt & Whitney JT8D-219	2	93.4			21000	0.75	6.467996575	10-20 knot	5.2-10.3	OK
21	MD-87	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89			20000	0.75	6.713399132	10-20 knot	5.2-10.3	OK
22	MD-88	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89			20000	0.75	6.610137087	10-20 knot	5.2-10.3	OK
23	MD-90-30	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2525-D5	2	111.2			25000	0.75	7.564430089	10-20 knot	5.2-10.3	OK
24	MD-90-30ER	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2528-D5	2	124.5			28000	0.75	8.472161699	10-20 knot	5.2-10.3	OK
25	B707-120B	86300	190000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	8.12982522	10-20 knot	5.2-10.3	OK
26	B707-320	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	7.463871452	10-20 knot	5.2-10.3	OK
27	B707-420	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	7.463871452	10-20 knot	5.2-10.3	OK
28	B707-320B	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	7.463871452	10-20 knot	5.2-10.3	OK
29	B707-320C	112100	247000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	6.258732529	10-20 knot	5.2-10.3	OK
30	B717-200	49898	110000	2 Turbofan Engines	Rolls-Royce BR700-715C1-30	2	95.3			21430	0.75	8.370059327	10-20 knot	5.2-10.3	OK
31	B720	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3C-7	4	53.4			12000	0.75	5.883470998	10-20 knot	5.2-10.3	OK
32	B720B	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3D-1	4	75.62			17000	0.75	8.334917247	10-20 knot	5.2-10.3	OK
33	B727-100	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3			14500	0.75	6.551556407	10-20 knot	5.2-10.3	OK
34	B727-100C	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3			14500	0.75	6.551556407	10-20 knot	5.2-10.3	OK
35	B727-200	73100	161000	3 Turbofan Engines	Pratt & Whitney JT8D-17	3	71.2			16000	0.75	6.39857653	10-20 knot	5.2-10.3	OK
36	B737-100	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3			14500	0.75	6.29293338	10-20 knot	5.2-10.3	OK
37	B737-200	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	6.674314274	10-20 knot	5.2-10.3	OK
38	B737-200-Convertible-Ex	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	6.674314274	10-20 knot	5.2-10.3	OK
39	B737-200 Advanced	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	6.424856037	10-20 knot	5.2-10.3	OK
40	B737-200C/-200QC	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	6.424856037	10-20 knot	5.2-10.3	OK
41	B737-300	52889	116000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9			22000	0.75	8.106750912	10-20 knot	5.2-10.3	OK
42	B737-400	56245	124000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9			22000	0.75	7.623041141	10-20 knot	5.2-10.3	OK
43	B737-500	49895	110000	2 Turbofan Engines	CFM Intl. CFM56-3C1	2	104.5			23500	0.75	9.17910503	10-20 knot	5.2-10.3	OK
44	B737-600	51936	121500	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	8.255505795	10-20 knot	5.2-10.3	OK
45	B737-700/-Winglets/-700C	58604	129200	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	7.31618915	10-20 knot	5.2-10.3	OK
46	B737-800/-800 Winglets	66361	146300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	8.01750481	10-20 knot	5.2-10.3	OK
47	B737-900/-900 Winglets	66814	147300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	7.963145997	10-20 knot	5.2-10.3	OK
48	B737-900ER/-900ER Winglets	71350	157300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	7.456897501	10-20 knot	5.2-10.3	OK
49	B737-BBJ	60781	134000	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	7.05414437	10-20 knot	5.2-10.3	OK
50	B737-BBJ2	66360	146300	2 Turbofan Engines	CFM Intl. CFM56-7B26	2	117.4			26400	0.75	7.7533083	10-20 knot	5.2-10.3	OK
51	B737 Max-7	66043	145600	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	8.262676363	10-20 knot	5.2-10.3	OK
52	B737 Max-8/-200-/-BBJ8	69308	152800	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	7.873433587	10-20 knot	5.2-10.3	OK

53	B737 Max-9	74343	163900	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	7.340192554	10-20 knot	5.2-10.3	OK
54	B747-100/-100B	265300	585000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	7.052181596	10-20 knot	5.2-10.3	OK
55	B747-100SF	255800	584000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	7.314088262	10-20 knot	5.2-10.3	OK
56	B747-100B SR	273500	564000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	6.840745072	10-20 knot	5.2-10.3	OK
57	B747-200B/-200B Combi	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	6.819962515	10-20 knot	5.2-10.3	OK
58	B747-200C	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	6.819962515	10-20 knot	5.2-10.3	OK
59	B747-200F	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	6.819962515	10-20 knot	5.2-10.3	OK
60	B747-300	255800	564000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	8.075972456	10-20 knot	5.2-10.3	OK
61	B747-300SR	242630	535000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	8.514337692	10-20 knot	5.2-10.3	OK
62	B747-300	260320	574000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	7.935747365	10-20 knot	5.2-10.3	OK
63	B747-300 Combi	274380	605000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	7.529097435	10-20 knot	5.2-10.3	OK
64	B747-SP	204100	450000	4 Turbofan Engines	Pratt & Whitney JT9D-7FW	4	218.4			49100	0.75	9.376871985	10-20 knot	5.2-10.3	OK
65	B747-400 (CF6-80C2B1 engines)	285764	630000	4 Turbofan Engines	General Electric CF6-80C2B1F	4	254.3			57160	0.75	7.796581147	10-20 knot	5.2-10.3	OK
66	B747-8	312072	688000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8			66498	0.75	8.305643363	10-20 knot	5.2-10.3	OK
67	B747-8F	345184	761000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8			66498	0.75	7.508919114	10-20 knot	5.2-10.3	OK
68	B757-200/-200PF	92250	210000	2 Turbofan Engines	Rolls-Royce RB.211-535E4-37	2	189			42500	0.75	8.978671018	10-20 knot	5.2-10.3	OK
69	B757-300	101610	224000	2 Turbofan Engines	Pratt & Whitney PW2043	2	189.49			42600	0.75	8.170763716	10-20 knot	5.2-10.3	OK
70	B767-200	123377	272000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5			48000	0.75	7.582222689	10-20 knot	5.2-10.3	OK
71	B767-200ER	136078	300000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5			48000	0.75	6.874527026	10-20 knot	5.2-10.3	OK
72	B767-300	136078	300000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	8.593158783	10-20 knot	5.2-10.3	OK
73	B767-300ER	145150	320000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	8.056078959	10-20 knot	5.2-10.3	OK
74	B767-300ER Freighter	147871	326000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	7.907837648	10-20 knot	5.2-10.3	OK
75	B767-400ER	158757	350000	2 Turbofan Engines	General Electric CF6-80C2B8F	2	282.46			63500	0.75	7.795255344	10-20 knot	5.2-10.3	OK
76	B777-200 (GE engines)	208700	460000	2 Turbofan Engines	General Electric GE90-94B	2	416.798			93700	0.75	8.749971647	10-20 knot	5.2-10.3	OK
77	B777-200 (P & W engines/RR engines)	206350	455000	2 Turbofan Engines	Pratt & Whitney PW4077	2	343.4			77200	0.75	7.291255735	10-20 knot	5.2-10.3	OK
78	B777-300	237680	524000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	9.081964756	10-20 knot	5.2-10.3	OK
79	B777-200LR	223168	492000	2 Turbofan Engines	General Electric GE90-115B	2	513.9			115540	0.75	10.08997164	10-20 knot	5.2-10.3	OK
80	B777-300ER	251290	554000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	8.590080716	10-20 knot	5.2-10.3	OK
81	B777-F	260816	575000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	8.276338043	10-20 knot	5.2-10.3	OK
82	B777-9	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5			78129	0.75	5.718723568	10-20 knot	5.2-10.3	OK
83	B777-9X/-8X	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5			78129	0.75	5.718723568	10-20 knot	5.2-10.3	OK
84	B787-8	172365	380000	2 Turbofan Engines	General Electric GEnx-1B70	2	321.6			72300	0.75	8.174829764	10-20 knot	5.2-10.3	OK
85	B787-9	192778	425000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6			78129	0.75	7.898494122	10-20 knot	5.2-10.3	OK
86	B787-10	201848	445000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6			78129	0.75	7.543576849	10-20 knot	5.2-10.3	OK
87	A300B2-100	127500	281089	2 Turbofan Engines	General Electric CF6-50C	2	226.859			51000	0.75	7.795599072	10-20 knot	5.2-10.3	OK
88	A300B2-200	130000	286600	2 Turbofan Engines	General Electric CF6-50C2	2	233.53			52500	0.75	7.870556756	10-20 knot	5.2-10.3	OK
89	A300B4-100	133000	293214	2 Turbofan Engines	General Electric CF6-50C2	2	233.53			52500	0.75	7.6930254	10-20 knot	5.2-10.3	OK
90	A300B4-600	134000	295419	2 Turbofan Engines	Pratt & Whitney PW4158	2	258			58000	0.75	8.435536309	10-20 knot	5.2-10.3	OK
91	A300C4-600	136000	299828	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3			60100	0.75	8.612417357	10-20 knot	5.2-10.3	OK
92	A300F4-200	136000	299828	2 Turbofan Engines	General Electric CF6-50C1	2	233.53			52500	0.75	7.52332631	10-20 knot	5.2-10.3	OK
93	A300F4-600	140000	308646	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3			60100	0.75	8.36634829	10-20 knot	5.2-10.3	OK
94	A310-200	118500	261247	2 Turbofan Engines	General Electric CF6-80A2	2	222.411			50000	0.75	8.223205772	10-20 knot	5.2-10.3	OK
95	A310-300	123000	271168	2 Turbofan Engines	Pratt & Whitney PW4152	2	232.197			52200	0.75	8.270940479	10-20 knot	5.2-10.3	OK
96	A318-100	57500	125766	2 Turbofan Engines	Pratt & Whitney PW6122	2	97.86			22000	0.75	7.456659982	10-20 knot	5.2-10.3	OK
97	A319-100	61000	134482	2 Turbofan Engines	CFM Intl. CFM56-5B5	2	97.86			22000	0.75	7.028818836	10-20 knot	5.2-10.3	OK
98	A319-Neo	62800	138450	2 Turbofan Engines	IAE International Aero Engines V2524-A5	2	104.533			23500	0.75	7.292857412	10-20 knot	5.2-10.3	OK
99	A320-200	64500	142198	2 Turbofan Engines	CFM Intl. CFM56-5A1	2	111.206			25000	0.75	7.55387507	10-20 knot	5.2-10.3	OK
100	A320-Neo	66300	146166	2 Turbofan Engines	IAE International Aero Engines V2527-A5	2	117.878			26500	0.75	7.789720038	10-20 knot	5.2-10.3	OK
101	A321-100	75500	166449	2 Turbofan Engines	FM Intl. CFM56-5B1/P	2	133.447			30000	0.75	7.743972588	10-20 knot	5.2-10.3	OK
102	A321-200	77800	171520	2 Turbofan Engines	FM Intl. CFM56-5B3/2P	2	142.3			32000	0.75	8.016040177	10-20 knot	5.2-10.3	OK
103	A321-Neo	79200	174606	2 Turbofan Engines	IAE International Aero Engines V2533-A5	2	146.791			33000	0.75	8.1204157	10-20 knot	5.2-10.3	OK
104	A330-200	180000	396832	2 Turbofan Engines	General Electric CF6-80E1A2	2	300.255			67500	0.75	7.30837413	10-20 knot	5.2-10.3	OK
105	A330-200F	182000	401241	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	7.345852972	10-20 knot	5.2-10.3	OK

106	A330-300	187000	412264	2 Turbofan Engines	Pratt & Whitney PW4164	2	284.686			64000	0.75	6.670031292	10-20 knot	5.2-10.3	OK
107	A330-800	186000	410060	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	7.187877639	10-20 knot	5.2-10.3	OK
108	A330-900	191000	421083	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	6.999713303	10-20 knot	5.2-10.3	OK
109	A340-200	185000	407855	4 Turbofan Engines	CFM Intl. CFM56-5C2	4	138.785			31200	0.75	6.573586245	10-20 knot	5.2-10.3	OK
110	A340-300	192000	410060	4 Turbofan Engines	CFM Intl. CFM56-5C4	4	151.2			34000	0.75	6.902353345	10-20 knot	5.2-10.3	OK
111	A340-500	246000	542337	4 Turbofan Engines	Rolls-Royce Trent 553-61	4	235.756			53000	0.75	8.397698188	10-20 knot	5.2-10.3	OK
112	A340-600	265000	584225	4 Turbofan Engines	Rolls-Royce Trent 556-61	4	249.1			56000	0.75	8.236859397	10-20 knot	5.2-10.3	OK
113	A350-900	205000	451948	2 Turbofan Engines	Trent XWB-84	2	373			84000	0.75	7.985735635	10-20 knot	5.2-10.3	OK
114	A350-1000	233000	513677	2 Turbofan Engines	Trent XWB-97	2	431.5			97000	0.75	8.113445386	10-20 knot	5.2-10.3	OK
115	A380-800	395000	870826	4 Turbofan engines	Engine Alliance GP7270	4	311.376			70000	0.75	6.907492849	10-20 knot	5.2-10.3	OK
116	BAE146-100A	35153	77499	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803			6700	0.75	7.42902651	10-20 knot	5.2-10.3	OK
117	BAE146-200	36741	81000	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041			6970	0.75	7.394372164	10-20 knot	5.2-10.3	OK
118	BAE146-300	38329	84501	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617			7500	0.75	7.626991709	10-20 knot	5.2-10.3	OK
119	Avro RJ70	37875	83500	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803			6700	0.75	6.895117331	10-20 knot	5.2-10.3	OK
120	Avro RJ85	38556	85001	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041			6970	0.75	7.046286639	10-20 knot	5.2-10.3	OK
121	Avro RJ100	40143	88500	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617			7500	0.75	7.282339766	10-20 knot	5.2-10.3	OK
122	Bombardier Challenger 300	15309	33750	2 Turbofan engines	Honeywell HTF 7000 (AS907)	2	28.9134			6500	0.75	8.274911167	10-20 knot	5.2-10.3	OK
123	Bombardier CL-600	16329	36000	2 Turbofan enginess	Avco Lycoming ALF502L	2	33.3617			7500	0.75	8.951226022	10-20 knot	5.2-10.3	OK
124	Bombardier CL-601-3A	16329	36000	2 Turbofan enginess	General Electric CF34-3A	2	41			9220	0.75	11.00404052	10-20 knot	5.2-10.3	OK
125	Bombardier CL-601-3R	16329	36000	2 Turbofan enginess	General Electric CF34-3A	2	41			9220	0.75	11.00404052	10-20 knot	5.2-10.3	OK
126	Bombardier CL-604	17237	38000	2 Turbofan enginess	General Electric CF34-3B	2	41			9220	0.75	10.4248805	10-20 knot	5.2-10.3	OK
127	Bombardier CL-605	17237	38000	2 Turbofan enginess	General Electric CF34-3B1	2	41			9220	0.75	10.4248805	10-20 knot	5.2-10.3	OK
128	LEARJET-24D	5389	11880	2 Turbojet engines	General Electric CJ610-6	2	13.1			2950	0.75	10.66913809	10-20 knot	5.2-10.3	OK
129	LEARJET-25D	6033	13300	2 Turbojet engines	General Electric CJ610-8A	2	13.1			2950	0.75	9.530027103	10-20 knot	5.2-10.3	OK
130	LEARJET-31A	7257	16000	2 Turbofan engines	Garrett TFE731-2	2	15.6			3500	0.75	9.398787323	10-20 knot	5.2-10.3	OK
131	LEARJET-35A/-36A	6940	15300	2 Turbofan engines	Garrett TFE731-2-2B	2	15.6			3500	0.75	9.828797201	10-20 knot	5.2-10.3	OK
132	LEARJET-40	8709	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20AR	2	15.6			3500	0.75	7.83232277	10-20 knot	5.2-10.3	OK
133	LEARJET-45X	8709	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20BR	2	15.6			3500	0.75	7.83232277	10-20 knot	5.2-10.3	OK
134	LEARJET-55	8165	18000	2 Turbofan engines	Garrett TFE731-3A-2B	2	16.236			3650	0.75	8.712526662	10-20 knot	5.2-10.3	OK
135	Bombardier CRJ-100/-200	20276	44700	2 Turbofan engines	General Electric CF34-3A1	2	41			9220	0.75	8.862130529	10-20 knot	5.2-10.3	OK
136	Bombardier CRJ-200LR	21319	47000	2 Turbofan engines	General Electric CF34-3B1	2	41			9220	0.75	8.428564127	10-20 knot	5.2-10.3	OK
137	Bombardier CRJ700	30390	67000	2 Turbofan engines	General Electric CF34-8C1	2	60.9			13700	0.75	8.785760718	10-20 knot	5.2-10.3	OK
138	Bombardier CRJ1000	36968	81500	2 Turbofan engines	General Electric CF34-8C5A1	2	64.4992			14500	0.75	7.644191365	10-20 knot	5.2-10.3	OK
139	Dornier 328 Jet/-300	14390	31724	2 Turbofan engines	Pratt & Whitney Canada PW306B	2	26.9			6050	0.75	8.193775953	10-20 knot	5.2-10.3	OK
140	EMB135BJ	18500	40785	2 Turbofan engines	Allison / Rolls-Royce AE3007A1/3	2	32.0272			7200	0.75	7.584907205	10-20 knot	5.2-10.3	OK
141	ERJ190-100LR	43000	94799	2 Turbofan engines	General Electric CF34-10E5	2	82.3			18500	0.75	8.384801328	10-20 knot	5.2-10.3	OK
142	F-28 Fellowship	29030	64000	2 Turbofan engines	Rolls-Royce RB.183 Spey Mk.555-15P	2	44.0374			9900	0.75	6.646265141	10-20 knot	5.2-10.3	OK
143	F-70	36740	81000	2 Turbofan engines	Rolls-Royce Tay 620-15	2	616			13850	0.75	7.346832277	10-20 knot	5.2-10.3	OK
144	F-100	38780	88000	2 Turbofan engines	Rolls-Royce Tay 650-15	2	672			15100	0.75	7.588547318	10-20 knot	5.2-10.3	OK
145	Cessna Citation Sovereign	12508	27575	2 Turbofan engines	Pratt & Whitney Canada PW306C	2	25.2926			5686	0.75	8.859485194	10-20 knot	5.2-10.3	OK
146	Cessna Citation Longitude	15195	33500	2 Turbofan engines	Honeywell HTF7700L	2	33.81			7600	0.75	9.747705322	10-20 knot	5.2-10.3	OK
147	Cessna Citation CJ1+	4491	9900	2 Turbofan engines	Williams / Rolls-Royce FJ44-1AP	2	8.5			1900	0.75	8.245977911	10-20 knot	5.2-10.3	OK
148	Cessna Citation CJ1	4445	9800	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5			1900	0.75	8.330120543	10-20 knot	5.2-10.3	OK
149	Cessna Citation CJ2+	5228	11525	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447			3000	0.75	11.18417828	10-20 knot	5.2-10.3	OK
150	Cessna Citation CJ2	5216	11500	2 Turbofan engines	Williams / Rolls-Royce FJ44-2C	2	10.6757			2400	0.75	8.966793372	10-20 knot	5.2-10.3	OK
151	Cessna Citation CJ3	5783	12750	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447			3000	0.75	10.10961998	10-20 knot	5.2-10.3	OK
152	Cessna Citation Encore	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	10.2354914	10-20 knot	5.2-10.3	OK
153	Cessna Citation Encore+	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	10.2354914	10-20 knot	5.2-10.3	OK
154	Cessna Citation II/-IISP	6123	13500	2 Turbofan engines	Pratt & Whitney Canada JT15D-4	2	11.1			2500	0.75	7.956645353	10-20 knot	5.2-10.3	OK
155	Cessna Citation I/-ISP	5148	11350	2 Turbofan engines	Pratt & Whitney Canada JT15D-1A	2	9.8			2200	0.75	8.328189145	10-20 knot	5.2-10.3	OK
156	Cessna Citation Jet	4400	9700	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5			1900	0.75	8.415998075	10-20 knot	5.2-10.3	OK
157	Cessna Citation Mustang	3629	8000	2 Turbofan engines	Pratt & Whitney Canada PW615F	2	6.0051			1350	0.75	7.250493078	10-20 knot	5.2-10.3	OK
158	Cessna Citation S/II	6350	14000	2 Turbofan engines	Pratt & Whitney Canada JT15D-4B	2	11.1			2500	0.75	7.672479448	10-20 knot	5.2-10.3	OK
159	Cessna Citation Ultra	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	10.2354914	10-20 knot	5.2-10.3	OK
160	Cessna Citation V	6895	15200	2 Turbofan engines	Pratt & Whitney Canada JT15D-5A	2	12.8998			2900	0.75	8.197438568	10-20 knot	5.2-10.3	OK
161	Cessna Citation Excel	8482	18700	2 Turbofan engines	Pratt & Whitney Canada PW545A	2	16.8321			3784	0.75	8.694273181	10-20 knot	5.2-10.3	OK
162	Cessna Citation III	9072	20000	2 Turbofan engines	Garrett TFE731-3-100S	2	16.2			3650	0.75	7.841273996	10-20 knot	5.2-10.3	OK
163	Cessna Citation VI	9072	20000	2 Turbofan engines	Garrett TFE731-3B-100	2	16.2			3650	0.75	7.841273996	10-20 knot	5.2-10.3	OK
164	Cessna Citation VII	9072	20000	2 Turbofan engines	Garrett TFE731-4	2	18.1487			4080	0.75	8.765040521	10-20 knot	5.2-10.3	OK
165	Cessna Citation XLS	8482	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C	2	28.6554			6442	0.75	14.8014027	10-20 knot	5.2-10.3	OK
166	Cessna Citation XLS+	8482	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C1	2	30.0878			6764	0.75	15.54124308	10-20 knot	5.2-10.3	OK

e. Gradien 2,5° (g = 4,4 %)

No	Aircraft	MLW		Propulsion	engines	n	Power engines				Engine	V taxiing Calculate	V taxiing range (knots)	V taxiing range (m/s)	Control
		Kg	Lbs			Engine	kN	kW	hp	lbf	efficiency				
1	DC-9-15	37059	81700	2 Turbofan Engines	Pratt & Whitney JT8D-7	2	62.3			14000	0.75	5.89065307	10-20 knot	5.2-10.3	OK
2	DC-9-21	43227	95300	2 Turbofan Engines	Pratt & Whitney JT8D-11	2	66.7			15000	0.75	5.410847192	10-20 knot	5.2-10.3	OK
3	DC-9-32	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-15	2	68.95			15500	0.75	5.38215787	10-20 knot	5.2-10.3	OK
4	DC-9-33F	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3			14500	0.75	5.034921878	10-20 knot	5.2-10.3	Cant Climb
5	DC-9-41	46266	102000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	5.392462521	10-20 knot	5.2-10.3	OK
6	DC-9-51	49895	110000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	5.000253953	10-20 knot	5.2-10.3	Cant Climb
7	DC-9-80	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2			16000	0.75	4.297066328	10-20 knot	5.2-10.3	Cant Climb
8	DC-8-61	108862	240000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	5.156503277	10-20 knot	5.2-10.3	Cant Climb
9	DC-8-63	117027	258000	4 Turbofan Engines	Pratt & Whitney JT3D-7	4	84.5			19000	0.75	5.063218049	10-20 knot	5.2-10.3	Cant Climb
10	DC-10-10	164881	363500	3 Turbofan Engines	General Electric CF6-6D	3	185			41500	0.75	5.887051692	10-20 knot	5.2-10.3	OK
11	DC-10-30	182798	403000	3 Turbofan Engines	General Electric CF6-50C	3	226			50800	0.75	6.49998924	10-20 knot	5.2-10.3	OK
12	DC-10-40	182798	403000	3 Turbofan Engines	Pratt and Whitney JT9D-20	3	219.7			49400	0.75	6.320855679	10-20 knot	5.2-10.3	OK
13	MD-11 -Passengger	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	7.277731036	10-20 knot	5.2-10.3	OK
14	MD-11 -Passengger-ER	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	7.277731036	10-20 knot	5.2-10.3	OK
15	MD-11-Combi	207749	458000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	6.83279767	10-20 knot	5.2-10.3	OK
16	MD-11-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	6.637179636	10-20 knot	5.2-10.3	OK
17	MD-11-Convertible-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270			60690	0.75	6.637179636	10-20 knot	5.2-10.3	OK
18	MD-81	58061	128000	2 Turbofan Engines	Pratt & Whitney JT8D-209	2	82.3			18500	0.75	4.968397368	10-20 knot	5.2-10.3	Cant Climb
19	MD-82	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217A	2	89			20000	0.75	5.288713836	10-20 knot	5.2-10.3	OK
20	MD-83	63276	139500	2 Turbofan Engines	Pratt & Whitney JT8D-219	2	93.4			21000	0.75	5.174988435	10-20 knot	5.2-10.3	Cant Climb
21	MD-87	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89			20000	0.75	5.37133291	10-20 knot	5.2-10.3	OK
22	MD-88	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89			20000	0.75	5.288713836	10-20 knot	5.2-10.3	OK
23	MD-90-30	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2525-D5	2	111.2			25000	0.75	6.05223546	10-20 knot	5.2-10.3	OK
24	MD-90-30ER	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2528-D5	2	124.5			28000	0.75	6.778503715	10-20 knot	5.2-10.3	OK
25	B707-120B	86300	190000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	6.504603242	10-20 knot	5.2-10.3	OK
26	B707-320	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	5.971779359	10-20 knot	5.2-10.3	OK
27	B707-420	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	5.971779359	10-20 knot	5.2-10.3	OK
28	B707-320B	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	5.971779359	10-20 knot	5.2-10.3	OK
29	B707-320C	112100	247000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1			18000	0.75	5.007558071	10-20 knot	5.2-10.3	Cant Climb
30	B717-200	49898	110000	2 Turbofan Engines	Rolls-Royce BR700-715C1-30	2	95.3			21430	0.75	6.696812485	10-20 knot	5.2-10.3	OK
31	B720	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3C-7	4	53.4			12000	0.75	4.707314547	10-20 knot	5.2-10.3	Cant Climb
32	B720B	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3D-1	4	75.62			17000	0.75	6.668695609	10-20 knot	5.2-10.3	OK
33	B727-100	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3			14500	0.75	5.241843938	10-20 knot	5.2-10.3	OK
34	B727-100C	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3			14500	0.75	5.241843938	10-20 knot	5.2-10.3	OK
35	B727-200	73100	161000	3 Turbofan Engines	Pratt & Whitney JT8D-17	3	71.2			16000	0.75	5.119446054	10-20 knot	5.2-10.3	Cant Climb
36	B737-100	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3			14500	0.75	5.034921878	10-20 knot	5.2-10.3	Cant Climb
37	B737-200	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	5.340061451	10-20 knot	5.2-10.3	OK
38	B737-200-Convertible-Ex	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	5.340061451	10-20 knot	5.2-10.3	OK
39	B737-200 Advanced	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	5.140472061	10-20 knot	5.2-10.3	Cant Climb
40	B737-200C/-200QC	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2			16000	0.75	5.140472061	10-20 knot	5.2-10.3	Cant Climb
41	B737-300	52889	116000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9			22000	0.75	6.486141686	10-20 knot	5.2-10.3	OK
42	B737-400	56245	124000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9			22000	0.75	6.099129658	10-20 knot	5.2-10.3	OK
43	B737-500	49895	110000	2 Turbofan Engines	CFM Intl. CFM56-3C1	2	104.5			23500	0.75	7.344122994	10-20 knot	5.2-10.3	OK
44	B737-600	51936	121500	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	6.605159189	10-20 knot	5.2-10.3	OK
45	B737-700/-Winglets/-700C	58604	129200	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	5.85362002	10-20 knot	5.2-10.3	OK
46	B737-800/-800 Winglets	66361	146300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	6.414736647	10-20 knot	5.2-10.3	OK
47	B737-900/-900 Winglets	66814	147300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	6.371244629	10-20 knot	5.2-10.3	OK
48	B737-900ER/-900ER Winglets	71350	157300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4			27300	0.75	5.966199561	10-20 knot	5.2-10.3	OK
49	B737-BBJ	60781	134000	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86			22000	0.75	5.643960245	10-20 knot	5.2-10.3	OK
50	B737-BBJ2	66360	146300	2 Turbofan Engines	CFM Intl. CFM56-7B26	2	117.4			26400	0.75	6.203355292	10-20 knot	5.2-10.3	OK
51	B737 Max-7	66043	145600	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	6.610896299	10-20 knot	5.2-10.3	OK
52	B737 Max-8/-200-/-BBJ8	69308	152800	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	6.299466501	10-20 knot	5.2-10.3	OK

53	B737 Max-9	74343	163900	2 Turbofan Engines	LEAP-1B28	2	124.5			28000	0.75	5.872824937	10-20 knot	5.2-10.3	OK
54	B747-100/-100B	265300	585000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	5.642389846	10-20 knot	5.2-10.3	OK
55	B747-100SF	255800	584000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	5.851939117	10-20 knot	5.2-10.3	OK
56	B747-100B SR	273500	564000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5			48000	0.75	5.473221302	10-20 knot	5.2-10.3	OK
57	B747-200B/-200B Combi	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	5.456593356	10-20 knot	5.2-10.3	OK
58	B747-200C	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	5.456593356	10-20 knot	5.2-10.3	OK
59	B747-200F	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4			50000	0.75	5.456593356	10-20 knot	5.2-10.3	OK
60	B747-300	255800	564000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	6.461516108	10-20 knot	5.2-10.3	OK
61	B747-300SR	242630	535000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	6.812248363	10-20 knot	5.2-10.3	OK
62	B747-300	260320	574000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	6.349323219	10-20 knot	5.2-10.3	OK
63	B747-300 Combi	274380	605000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76			53000	0.75	6.023966107	10-20 knot	5.2-10.3	OK
64	B747-SP	204100	450000	4 Turbofan Engines	Pratt & Whitney JT9D-7FW	4	218.4			49100	0.75	7.502354634	10-20 knot	5.2-10.3	OK
65	B747-400 (CF6-80C2B1 engines)	285764	630000	4 Turbofan Engines	General Electric CF6-80C2B1F	4	254.3			57160	0.75	6.237977525	10-20 knot	5.2-10.3	OK
66	B747-8	312072	688000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8			66498	0.75	6.645273826	10-20 knot	5.2-10.3	OK
67	B747-8F	345184	761000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8			66498	0.75	6.007821606	10-20 knot	5.2-10.3	OK
68	B757-200/-200PF	92250	210000	2 Turbofan Engines	Rolls-Royce RB.211-535E4-37	2	189			42500	0.75	7.183757465	10-20 knot	5.2-10.3	OK
69	B757-300	101610	224000	2 Turbofan Engines	Pratt & Whitney PW2043	2	189.49			42600	0.75	6.53735778	10-20 knot	5.2-10.3	OK
70	B767-200	123377	272000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5			48000	0.75	6.066471166	10-20 knot	5.2-10.3	OK
71	B767-200ER	136078	300000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5			48000	0.75	5.500249952	10-20 knot	5.2-10.3	OK
72	B767-300	136078	300000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	6.87531244	10-20 knot	5.2-10.3	OK
73	B767-300ER	145150	320000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	6.445599492	10-20 knot	5.2-10.3	OK
74	B767-300ER Freighter	147871	326000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89			60000	0.75	6.326992894	10-20 knot	5.2-10.3	OK
75	B767-400ER	158757	350000	2 Turbofan Engines	General Electric CF6-80C2B8F	2	282.46			63500	0.75	6.236916762	10-20 knot	5.2-10.3	OK
76	B777-200 (GE engines)	208700	460000	2 Turbofan Engines	General Electric GE90-94B	2	416.798			93700	0.75	7.000777064	10-20 knot	5.2-10.3	OK
77	B777-200 (P & W engines/RR engines)	206350	455000	2 Turbofan Engines	Pratt & Whitney PW4077	2	343.4			77200	0.75	5.833671009	10-20 knot	5.2-10.3	OK
78	B777-300	237680	524000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	7.266401896	10-20 knot	5.2-10.3	OK
79	B777-200LR	223168	492000	2 Turbofan Engines	General Electric GE90-115B	2	513.9			115540	0.75	8.072899539	10-20 knot	5.2-10.3	OK
80	B777-300ER	251290	554000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	6.872849706	10-20 knot	5.2-10.3	OK
81	B777-F	260816	575000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7			110760	0.75	6.621826892	10-20 knot	5.2-10.3	OK
82	B777-9	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5			78129	0.75	4.575501546	10-20 knot	5.2-10.3	Cant Climb
83	B777-9X/-8X	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5			78129	0.75	4.575501546	10-20 knot	5.2-10.3	Cant Climb
84	B787-8	172365	380000	2 Turbofan Engines	General Electric GEnx-1B70	2	321.6			72300	0.75	6.54061099	10-20 knot	5.2-10.3	OK
85	B787-9	192778	425000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6			78129	0.75	6.319517219	10-20 knot	5.2-10.3	OK
86	B787-10	201848	445000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6			78129	0.75	6.035550962	10-20 knot	5.2-10.3	OK
87	A300B2-100	127500	281089	2 Turbofan Engines	General Electric CF6-50C	2	226.859			51000	0.75	6.237191775	10-20 knot	5.2-10.3	OK
88	A300B2-200	130000	286600	2 Turbofan Engines	General Electric CF6-50C2	2	233.53			52500	0.75	6.297164773	10-20 knot	5.2-10.3	OK
89	A300B4-100	133000	293214	2 Turbofan Engines	General Electric CF6-50C2	2	233.53			52500	0.75	6.155123462	10-20 knot	5.2-10.3	OK
90	A300B4-600	134000	295419	2 Turbofan Engines	Pratt & Whitney PW4158	2	258			58000	0.75	6.749200055	10-20 knot	5.2-10.3	OK
91	A300C4-600	136000	299828	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3			60100	0.75	6.89072106	10-20 knot	5.2-10.3	OK
92	A300F4-200	136000	299828	2 Turbofan Engines	General Electric CF6-50C1	2	233.53			52500	0.75	6.01934868	10-20 knot	5.2-10.3	OK
93	A300F4-600	140000	308646	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3			60100	0.75	6.693843316	10-20 knot	5.2-10.3	OK
94	A310-200	118500	261247	2 Turbofan Engines	General Electric CF6-80A2	2	222.411			50000	0.75	6.579316219	10-20 knot	5.2-10.3	OK
95	A310-300	123000	271168	2 Turbofan Engines	Pratt & Whitney PW4152	2	232.197			52200	0.75	6.617508347	10-20 knot	5.2-10.3	OK
96	A318-100	57500	125766	2 Turbofan Engines	Pratt & Whitney PW6122	2	97.86			22000	0.75	5.966009524	10-20 knot	5.2-10.3	OK
97	A319-100	61000	134482	2 Turbofan Engines	CFM Intl. CFM56-5B5	2	97.86			22000	0.75	5.623697502	10-20 knot	5.2-10.3	OK
98	A319-Neo	62800	138450	2 Turbofan Engines	IAE International Aero Engines V2524-A5	2	104.533			23500	0.75	5.834952497	10-20 knot	5.2-10.3	OK
99	A320-200	64500	142198	2 Turbofan Engines	CFM Intl. CFM56-5A1	2	111.206			25000	0.75	6.04379048	10-20 knot	5.2-10.3	OK
100	A320-Neo	66300	146166	2 Turbofan Engines	IAE International Aero Engines V2527-A5	2	117.878			26500	0.75	6.232488011	10-20 knot	5.2-10.3	OK
101	A321-100	75500	166449	2 Turbofan Engines	FM Intl. CFM56-5B1/P	2	133.447			30000	0.75	6.195885869	10-20 knot	5.2-10.3	OK
102	A321-200	77800	171520	2 Turbofan Engines	FM Intl. CFM56-5B3/2P	2	142.3			32000	0.75	6.413564807	10-20 knot	5.2-10.3	OK
103	A321-Neo	79200	174606	2 Turbofan Engines	IAE International Aero Engines V2533-A5	2	146.791			33000	0.75	6.497074766	10-20 knot	5.2-10.3	OK
104	A330-200	180000	396832	2 Turbofan Engines	General Electric CF6-80E1A2	2	300.255			67500	0.75	5.847367289	10-20 knot	5.2-10.3	OK
105	A330-200F	182000	401241	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	5.877353788	10-20 knot	5.2-10.3	OK

106	A330-300	187000	412264	2 Turbofan Engines	Pratt & Whitney PW4164	2	284.686			64000	0.75	5.336634674	10-20 knot	5.2-10.3	OK
107	A330-800	186000	410060	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	5.750959083	10-20 knot	5.2-10.3	OK
108	A330-900	191000	421083	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148			68600	0.75	5.600410416	10-20 knot	5.2-10.3	OK
109	A340-200	185000	407855	4 Turbofan Engines	CFM Intl. CFM56-5C2	4	138.785			31200	0.75	5.259469821	10-20 knot	5.2-10.3	OK
110	A340-300	192000	410060	4 Turbofan Engines	CFM Intl. CFM56-5C4	4	151.2			34000	0.75	5.522513551	10-20 knot	5.2-10.3	OK
111	A340-500	246000	542337	4 Turbofan Engines	Rolls-Royce Trent 553-61	4	235.756			53000	0.75	6.718926099	10-20 knot	5.2-10.3	OK
112	A340-600	265000	584225	4 Turbofan Engines	Rolls-Royce Trent 556-61	4	249.1			56000	0.75	6.590240366	10-20 knot	5.2-10.3	OK
113	A350-900	205000	451948	2 Turbofan Engines	Trent XWB-84	2	373			84000	0.75	6.389318404	10-20 knot	5.2-10.3	OK
114	A350-1000	233000	513677	2 Turbofan Engines	Trent XWB-97	2	431.5			97000	0.75	6.491497878	10-20 knot	5.2-10.3	OK
115	A380-800	395000	870826	4 Turbofan engines	Engine Alliance GP7270	4	311.376			70000	0.75	5.526625624	10-20 knot	5.2-10.3	OK
116	BAE146-100A	35153	77499	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803			6700	0.75	5.943900221	10-20 knot	5.2-10.3	OK
117	BAE146-200	36741	81000	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041			6970	0.75	5.916173576	10-20 knot	5.2-10.3	OK
118	BAE146-300	38329	84501	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617			7500	0.75	6.102290474	10-20 knot	5.2-10.3	OK
119	Avro RJ70	37875	83500	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803			6700	0.75	5.516724078	10-20 knot	5.2-10.3	OK
120	Avro RJ85	38556	85001	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041			6970	0.75	5.637673342	10-20 knot	5.2-10.3	OK
121	Avro RJ100	40143	88500	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617			7500	0.75	5.826537418	10-20 knot	5.2-10.3	OK
122	Bombardier Challenger 300	15309	33750	2 Turbofan engines	Honeywell HTF 7000 (AS907)	2	28.9134			6500	0.75	6.62068526	10-20 knot	5.2-10.3	OK
123	Bombardier CL-600	16329	36000	2 Turbofan enginess	Avco Lycoming ALF502L	2	33.3617			7500	0.75	7.16179896	10-20 knot	5.2-10.3	OK
124	Bombardier CL-601-3A	16329	36000	2 Turbofan enginess	General Electric CF34-3A	2	41			9220	0.75	8.804238188	10-20 knot	5.2-10.3	OK
125	Bombardier CL-601-3R	16329	36000	2 Turbofan enginess	General Electric CF34-3A	2	41			9220	0.75	8.804238188	10-20 knot	5.2-10.3	OK
126	Bombardier CL-604	17237	38000	2 Turbofan enginess	General Electric CF34-3B	2	41			9220	0.75	8.34085723	10-20 knot	5.2-10.3	OK
127	Bombardier CL-605	17237	38000	2 Turbofan enginess	General Electric CF34-3B1	2	41			9220	0.75	8.34085723	10-20 knot	5.2-10.3	OK
128	LEARJET-24D	5389	11880	2 Turbojet engines	General Electric CJ610-6	2	13.1			2950	0.75	8.536285629	10-20 knot	5.2-10.3	OK
129	LEARJET-25D	6033	13300	2 Turbojet engines	General Electric CJ610-8A	2	13.1			2950	0.75	7.624892727	10-20 knot	5.2-10.3	OK
130	LEARJET-31A	7257	16000	2 Turbofan engines	Garrett TFE731-2	2	15.6			3500	0.75	7.519888908	10-20 knot	5.2-10.3	OK
131	LEARJET-35A/-36A	6940	15300	2 Turbofan engines	Garrett TFE731-2-2B	2	15.6			3500	0.75	7.863936112	10-20 knot	5.2-10.3	OK
132	LEARJET-40	8709	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20AR	2	15.6			3500	0.75	6.26657409	10-20 knot	5.2-10.3	OK
133	LEARJET-45X	8709	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20BR	2	15.6			3500	0.75	6.26657409	10-20 knot	5.2-10.3	OK
134	LEARJET-55	8165	18000	2 Turbofan engines	Garrett TFE731-3A-2B	2	16.236			3650	0.75	6.970817654	10-20 knot	5.2-10.3	OK
135	Bombardier CRJ-100/-200	20276	44700	2 Turbofan engines	General Electric CF34-3A1	2	41			9220	0.75	7.090514422	10-20 knot	5.2-10.3	OK
136	Bombardier CRJ-200LR	21319	47000	2 Turbofan engines	General Electric CF34-3B1	2	41			9220	0.75	6.743621672	10-20 knot	5.2-10.3	OK
137	Bombardier CRJ700	30390	67000	2 Turbofan engines	General Electric CF34-8C1	2	60.9			13700	0.75	7.029411593	10-20 knot	5.2-10.3	OK
138	Bombardier CRJ1000	36968	81500	2 Turbofan engines	General Electric CF34-8C5A1	2	64.4992			14500	0.75	6.11605177	10-20 knot	5.2-10.3	OK
139	Dornier 328 Jet/-300	14390	31724	2 Turbofan engines	Pratt & Whitney Canada PW306B	2	26.9			6050	0.75	6.555769673	10-20 knot	5.2-10.3	OK
140	EMB135BJ	18500	40785	2 Turbofan engines	Allison / Rolls-Royce AE3007A1/3	2	32.0272			7200	0.75	6.068619025	10-20 knot	5.2-10.3	OK
141	ERJ190-100LR	43000	94799	2 Turbofan engines	General Electric CF34-10E5	2	82.3			18500	0.75	6.708607433	10-20 knot	5.2-10.3	OK
142	F-28 Fellowship	29030	64000	2 Turbofan engines	Rolls-Royce RB.183 Spey Mk.555-15P	2	44.0374			9900	0.75	5.317619581	10-20 knot	5.2-10.3	OK
143	F-70	36740	81000	2 Turbofan engines	Rolls-Royce Tay 620-15	2	616			13850	0.75	5.878137322	10-20 knot	5.2-10.3	OK
144	F-100	38780	88000	2 Turbofan engines	Rolls-Royce Tay 650-15	2	672			15100	0.75	6.071531447	10-20 knot	5.2-10.3	OK
145	Cessna Citation Sovereign	12508	27575	2 Turbofan engines	Pratt & Whitney Canada PW306C	2	25.2926			5686	0.75	7.088397912	10-20 knot	5.2-10.3	OK
146	Cessna Citation Longitude	15195	33500	2 Turbofan engines	Honeywell HTF7700L	2	33.81			7600	0.75	7.799055198	10-20 knot	5.2-10.3	OK
147	Cessna Citation CJ1+	4491	9900	2 Turbofan engines	Williams / Rolls-Royce FJ44-1AP	2	8.5			1900	0.75	6.597536011	10-20 knot	5.2-10.3	OK
148	Cessna Citation CJ1	4445	9800	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5			1900	0.75	6.664857807	10-20 knot	5.2-10.3	OK
149	Cessna Citation CJ2+	5228	11525	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447			3000	0.75	8.948364861	10-20 knot	5.2-10.3	OK
150	Cessna Citation CJ2	5216	11500	2 Turbofan engines	Williams / Rolls-Royce FJ44-2C	2	10.6757			2400	0.75	7.174254262	10-20 knot	5.2-10.3	OK
151	Cessna Citation CJ3	5783	12750	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447			3000	0.75	8.088620001	10-20 knot	5.2-10.3	OK
152	Cessna Citation Encore	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	8.189328642	10-20 knot	5.2-10.3	OK
153	Cessna Citation Encore+	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	8.189328642	10-20 knot	5.2-10.3	OK
154	Cessna Citation II/-IISP	6123	13500	2 Turbofan engines	Pratt & Whitney Canada JT15D-4	2	11.1			2500	0.75	6.36604352	10-20 knot	5.2-10.3	OK
155	Cessna Citation I/-ISP	5148	11350	2 Turbofan engines	Pratt & Whitney Canada JT15D-1A	2	9.8			2200	0.75	6.663312512	10-20 knot	5.2-10.3	OK
156	Cessna Citation Jet	4400	9700	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5			1900	0.75	6.733567682	10-20 knot	5.2-10.3	OK
157	Cessna Citation Mustang	3629	8000	2 Turbofan engines	Pratt & Whitney Canada PW615F	2	6.0051			1350	0.75	5.801057157	10-20 knot	5.2-10.3	OK
158	Cessna Citation S/II	6350	14000	2 Turbofan engines	Pratt & Whitney Canada JT15D-4B	2	11.1			2500	0.75	6.138684822	10-20 knot	5.2-10.3	OK
159	Cessna Citation Ultra	6895	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107			3621	0.75	8.189328642	10-20 knot	5.2-10.3	OK
160	Cessna Citation V	6895	15200	2 Turbofan engines	Pratt & Whitney Canada JT15D-5A	2	12.8998			2900	0.75	6.5587001	10-20 knot	5.2-10.3	OK
161	Cessna Citation Excel	8482	18700	2 Turbofan engines	Pratt & Whitney Canada PW545A	2	16.8321			3784	0.75	6.956213201	10-20 knot	5.2-10.3	OK
162	Cessna Citation III	9072	20000	2 Turbofan engines	Garrett TFE731-3-100S	2	16.2			3650	0.75	6.273735889	10-20 knot	5.2-10.3	OK
163	Cessna Citation VI	9072	20000	2 Turbofan engines	Garrett TFE731-3B-100	2	16.2			3650	0.75	6.273735889	10-20 knot	5.2-10.3	OK
164	Cessna Citation VII	9072	20000	2 Turbofan engines	Garrett TFE731-4	2	18.1487			4080	0.75	7.012833541	10-20 knot	5.2-10.3	OK
165	Cessna Citation XLS	8482	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C	2	28.6554			6442	0.75	11.84247501	10-20 knot	5.2-10.3	OK
166	Cessna Citation XLS+	8482	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C1	2	30.0878			6764	0.75	12.43441493	10-20 knot	5.2-10.3	OK

LAMPIRAN III
TABEL PERHITUNGAN TINGKAT KONSUMSI BAHAN BAKAR

a. Gradien 0° (g = 0 %)

No	Aircraft	MLW		Propulsion	engines	n Engine	Power engines				Engine efficiency	V taxiing Calculated (m/s)	V application (m/s)	Time (s)	Resultant Force (lbf)	SFC (lb/lbf/h)	Fuel Consumpstion (lb)	Biaya
		Kg	Lbs				kN	kW	hp	lbf								
1	DC-9-15	37059	81700	2 Turbofan Engines	Pratt & Whitney JT8D-7	2	62.3	0	0	14000	0.75	256.9466781	5.2	62.5	346.5639091	0.585	3.519789702	Rp 19,122.88
2	DC-9-21	43227	95300	2 Turbofan Engines	Pratt & Whitney JT8D-11	2	66.7	0	0	15000	0.75	236.0178396	5.2	62.5	404.2450714	0.62	4.351249032	Rp 23,640.16
3	DC-9-32	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-15	2	68.95	0	0	15500	0.75	234.766429	5.2	62.5	419.9465421	0.62	4.520257918	Rp 24,558.38
4	DC-9-33F	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3	0	0	14500	0.75	219.6202077	5.2	62.5	419.9465421	0.565	4.119267296	Rp 22,379.81
5	DC-9-41	46266	102000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	235.2159116	5.2	62.5	432.6648269	0.6	4.50692528	Rp 24,485.94
6	DC-9-51	49895	110000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	218.1080141	5.2	62.5	466.6020736	0.6	4.860438267	Rp 26,406.57
7	DC-9-80	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	187.4354007	5.2	62.5	542.9585408	0.6	5.655818133	Rp 30,727.83
8	DC-8-61	108862	240000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	224.9235139	5.2	62.5	1018.042588	0.51	9.013918749	Rp 48,972.26
9	DC-8-63	117027	258000	4 Turbofan Engines	Pratt & Whitney JT3D-7	4	84.5	0	0	19000	0.75	220.8544694	5.2	62.5	1094.399055	0.52	9.879991472	Rp 53,677.60
10	DC-10-10	164881	363500	3 Turbofan Engines	General Electric CF6-6D	3	185	0	0	41500	0.75	256.7895882	5.2	62.5	1541.91435	0.35	9.369271224	Rp 50,902.87
11	DC-10-30	182798	403000	3 Turbofan Engines	General Electric CF6-50C	3	226	0	0	50800	0.75	283.5255485	5.2	62.5	1709.468401	0.394	11.69323871	Rp 63,528.90
12	DC-10-40	182798	403000	3 Turbofan Engines	Pratt and Whitney JT9D-20	3	219.7	0	0	49400	0.75	275.7118523	5.2	62.5	1709.468401	0.37	10.98096021	Rp 59,659.12
13	MD-11 -Passengger	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	317.4501692	5.2	62.5	1824.026481	0.322	10.1968147	Rp 55,398.88
14	MD-11 -Passengger-ER	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	317.4501692	5.2	62.5	1824.026481	0.322	10.1968147	Rp 55,398.88
15	MD-11-Combi	207749	458000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	298.0424484	5.2	62.5	1942.802168	0.322	10.86080379	Rp 59,006.31
16	MD-11-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	289.5097096	5.2	62.5	2000.062505	0.322	11.18090498	Rp 60,745.41
17	MD-11-Convertible-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	289.5097096	5.2	62.5	2000.062505	0.322	11.18090498	Rp 60,745.41
18	MD-81	58061	128000	2 Turbofan Engines	Pratt & Whitney JT8D-209	2	82.3	0	0	18500	0.75	216.7184494	5.2	62.5	542.9678925	0.51	4.807528215	Rp 26,119.11
19	MD-82	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217A	2	89	0	0	20000	0.75	230.6904575	5.2	62.5	551.4405146	0.53	5.074018624	Rp 27,566.94
20	MD-83	63276	139500	2 Turbofan Engines	Pratt & Whitney JT8D-219	2	93.4	0	0	21000	0.75	225.7298251	5.2	62.5	591.7369037	0.519	5.331796059	Rp 28,967.43
21	MD-87	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89	0	0	20000	0.75	234.2942509	5.2	62.5	542.9585408	0.5	4.713181778	Rp 25,606.53
22	MD-88	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89	0	0	20000	0.75	230.6904575	5.2	62.5	551.4405146	0.5	4.786810022	Rp 26,006.55
23	MD-90-30	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2525-D5	2	111.2	0	0	25000	0.75	263.9948029	5.2	62.5	602.3417088	0.35	3.660062467	Rp 19,884.97
24	MD-90-30ER	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2528-D5	2	124.5	0	0	28000	0.75	295.6741793	5.2	62.5	602.3417088	0.35	3.660062467	Rp 19,884.97
25	B707-120B	86300	190000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	283.7268085	5.2	62.5	807.049984	0.51	7.145755067	Rp 38,822.60
26	B707-320	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	260.4853571	5.2	62.5	879.05792	0.51	7.783325333	Rp 42,286.49
27	B707-420	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	260.4853571	5.2	62.5	879.05792	0.51	7.783325333	Rp 42,286.49
28	B707-320B	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	260.4853571	5.2	62.5	879.05792	0.51	7.783325333	Rp 42,286.49
29	B707-320C	112100	247000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	218.4266153	5.2	62.5	1048.323328	0.51	9.282029467	Rp 50,428.89
30	B717-200	49898	110000	2 Turbofan Engines	Rolls-Royce BR700-715C1-30	2	95.3	0	0	21430	0.75	292.1108579	5.2	62.5	466.6301286	0.37	2.997450479	Rp 16,285.03
31	B720	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3C-7	4	53.4	0	0	12000	0.75	205.3301767	5.2	62.5	743.45856	0.785	10.13220433	Rp 55,047.86
32	B720B	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3D-1	4	75.62	0	0	17000	0.75	290.884417	5.2	62.5	743.45856	0.52	6.711778667	Rp 36,464.82
33	B727-100	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3	0	0	14500	0.75	228.6460212	5.2	62.5	605.053696	0.565	5.934988511	Rp 32,244.55
34	B727-100C	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3	0	0	14500	0.75	228.6460212	5.2	62.5	605.053696	0.565	5.934988511	Rp 32,244.55
35	B727-200	73100	161000	3 Turbofan Engines	Pratt & Whitney JT8D-17	3	71.2	0	0	16000	0.75	223.3071005	5.2	62.5	683.607808	0.6	7.120914667	Rp 38,687.64
36	B737-100	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3	0	0	14500	0.75	219.6202077	5.2	62.5	419.9465421	0.565	4.119267296	Rp 22,379.81
37	B737-200	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	232.930209	5.2	62.5	436.9104896	0.6	4.551150933	Rp 24,726.22
38	B737-200-Convertible-Ex	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	232.930209	5.2	62.5	436.9104896	0.6	4.551150933	Rp 24,726.22
39	B737-200 Advanced	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	224.2242421	5.2	62.5	453.8744371	0.6	4.72785872	Rp 25,686.27
40	B737-200C/-200QC	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	224.2242421	5.2	62.5	453.8744371	0.6	4.72785872	Rp 25,686.27
41	B737-300	52889	116000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9	0	0	22000	0.75	282.9215267	5.2	62.5	494.6010035	0.39	3.348860961	Rp 18,194.23
42	B737-400	56245	124000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9	0	0	22000	0.75	266.0402992	5.2	62.5	525.9852416	0.39	3.561358407	Rp 19,348.72
43	B737-500	49895	110000	2 Turbofan Engines	CFM Intl. CFM56-3C1	2	104.5	0	0	23500	0.75	320.3461457	5.2	62.5	466.6020736	0.33	2.673241047	Rp 14,523.61
44	B737-600	51936	121500	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	288.1129973	5.2	62.5	485.6888525	0.36	3.035555328	Rp 16,492.05
45	B737-700/-Winglets/-700C	58604	129200	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	255.3313191	5.2	62.5	548.0458547	0.36	3.425286592	Rp 18,609.44
46	B737-800/-800 Winglets	66361	146300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	279.8068827	5.2	62.5	620.5868365	0.38	4.094149268	Rp 22,243.35
47	B737-900/-900 Winglets	66814	147300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	277.9097875	5.2	62.5	624.8231475	0.38	4.122097154	Rp 22,395.19
48	B737-900ER/-900ER Winglets	71350	157300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	260.2419697	5.2	62.5	667.242368	0.38	4.401946178	Rp 23,915.60
49	B737-BBJ	60781	134000	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	246.1860882	5.2	62.5	568.4044621	0.36	3.552527888	Rp 19,300.74
50	B737-BBJ2	66360	146300	2 Turbofan Engines	CFM Intl. CFM56-7B26	2	117.4	0	0	26400	0.75	270.5865574	5.2	62.5	620.5774848	0.38	4.094087573	Rp 22,243.01
51	B737 Max-7	66043	145600	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	288.3632465	5.2	62.5	617.6130022	0.342	3.667077201	Rp 19,923.08
52	B737 Max-8/-200-/-BBJ8	69308	152800	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	274.7788695	5.2	62.5	648.1462374	0.342	3.848368285	Rp 20,908.03
53	B737 Max-9	74343	163900	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	256.1690258	5.2	62.5	695.2319462	0.342	4.127939681	Rp 22,426.93
54	B747-100/-100B	265300	585000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	246.1175883	5.2	62.5	2481.000704	0.367	15.8077649	Rp 85,882.95
55	B747-100SF	255800	584000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	255.2579992	5.2	62.5	2392.159744	0.367	15.24171226	Rp 82,807.61

56	B747-100B SR	273500	564000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	238.7385601	5.2	62.5	2557.68448	0.367	16.29635771	Rp	88,537.46
57	B747-200B/-200B Combi	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	238.0132593	5.2	62.5	2672.373484	0.343	15.91361293	Rp	86,458.02
58	B747-200C	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	238.0132593	5.2	62.5	2672.373484	0.343	15.91361293	Rp	86,458.02
59	B747-200F	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	238.0132593	5.2	62.5	2672.373484	0.343	15.91361293	Rp	86,458.02
60	B747-300	255800	564000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	281.8473741	5.2	62.5	2392.159744	0.373	15.49089556	Rp	84,161.41
61	B747-300SR	242630	535000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	297.1461002	5.2	62.5	2268.998118	0.373	14.69333851	Rp	79,828.32
62	B747-300	260320	574000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	276.953589	5.2	62.5	2434.429338	0.373	15.76462054	Rp	85,648.55
63	B747-300 Combi	274380	605000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	262.7617111	5.2	62.5	2565.913958	0.373	16.61607477	Rp	90,274.47
64	B747-SP	204100	450000	4 Turbofan Engines	Pratt & Whitney JT9D-7FW	4	218.4	0	0	49100	0.75	327.2481129	5.2	62.5	1908.677888	0.367	12.16119418	Rp	66,071.28
65	B747-400 (CF6-80C2B1 engines)	285764	630000	4 Turbofan Engines	General Electric CF6-80C2B1F	4	254.3	0	0	57160	0.75	272.096758	5.2	62.5	2672.373484	0.314	14.56814712	Rp	79,148.16
66	B747-8	312072	688000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8	0	0	66498	0.75	289.8627732	5.2	62.5	2918.397481	0.324	16.41598583	Rp	89,187.39
67	B747-8F	345184	761000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8	0	0	66498	0.75	262.0574979	5.2	62.5	3228.050309	0.324	18.15778299	Rp	98,650.51
68	B757-200/-200PF	92250	210000	2 Turbofan Engines	Rolls-Royce RB.211-535E4-37	2	189	0	0	42500	0.75	313.3510996	5.2	62.5	862.69248	0.324	4.8526452	Rp	26,364.23
69	B757-300	101610	224000	2 Turbofan Engines	Pratt & Whitney PW2043	2	189.49	0	0	42600	0.75	285.1555414	5.2	62.5	950.2242048	0.35	5.7739318	Rp	31,369.54
70	B767-200	123377	272000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5	0	0	48000	0.75	264.6157557	5.2	62.5	1153.782223	0.343	6.870612893	Rp	37,327.76
71	B767-200ER	136078	300000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5	0	0	48000	0.75	239.9175333	5.2	62.5	1272.557911	0.343	7.577905616	Rp	41,170.46
72	B767-300	136078	300000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	299.8969166	5.2	62.5	1272.557911	0.33	7.290696365	Rp	39,610.06
73	B767-300ER	145150	320000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	281.153101	5.2	62.5	1357.396352	0.33	7.776749933	Rp	42,250.77
74	B767-300ER Freighter	147871	326000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	275.9795539	5.2	62.5	1382.842273	0.33	7.922533857	Rp	43,042.81
75	B767-400ER	158757	350000	2 Turbofan Engines	General Electric CF6-80C2B8F	2	282.46	0	0	63500	0.75	272.0504882	5.2	62.5	1484.644662	0.323	8.325351141	Rp	45,231.30
76	B777-200 (GE engines)	208700	460000	2 Turbofan Engines	General Electric GE90-94B	2	416.798	0	0	93700	0.75	305.3696066	5.2	62.5	1951.695616	0.324	10.97828784	Rp	59,644.60
77	B777-200 (P & W engines/RR engines)	206350	455000	2 Turbofan Engines	Pratt & Whitney PW4077	2	343.4	0	0	77200	0.75	254.4611555	5.2	62.5	1929.719168	0.33	11.05568273	Rp	60,065.08
78	B777-300	237680	524000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	316.955999	5.2	62.5	2222.707302	0.324	12.50272858	Rp	67,926.82
79	B777-200LR	223168	492000	2 Turbofan Engines	General Electric GE90-115B	2	513.9	0	0	115540	0.75	352.1349321	5.2	62.5	2086.995722	0.324	11.73935094	Rp	63,779.42
80	B777-300ER	251290	554000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	299.7894936	5.2	62.5	2349.983667	0.324	13.21865813	Rp	71,816.44
81	B777-F	260816	575000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	288.8400322	5.2	62.5	2439.067771	0.324	13.71975621	Rp	74,538.88
82	B777-9	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5	0	0	78129	0.75	199.5805743	5.2	62.5	2489.959613	0.45	19.45280948	Rp	105,686.33
83	B777-9X/-8X	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5	0	0	78129	0.75	199.5805743	5.2	62.5	2489.959613	0.45	19.45280948	Rp	105,686.33
84	B787-8	172365	380000	2 Turbofan Engines	General Electric GEnx-1B70	2	321.6	0	0	72300	0.75	285.2974444	5.2	62.5	1611.902323	0.45	12.5929869	Rp	68,417.19
85	B787-9	192778	425000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6	0	0	78129	0.75	275.6534696	5.2	62.5	1802.798167	0.45	14.08436068	Rp	76,519.77
86	B787-10	201848	445000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6	0	0	78129	0.75	263.2670354	5.2	62.5	1887.617905	0.45	14.74701488	Rp	80,119.94
87	A300B2-100	127500	281089	2 Turbofan Engines	General Electric CF6-50C	2	226.859	0	0	51000	0.75	272.0624841	5.2	62.5	1192.3392	0.394	8.155931333	Rp	44,310.85
88	A300B2-200	130000	286600	2 Turbofan Engines	General Electric CF6-50C2	2	233.53	0	0	52500	0.75	274.6784695	5.2	62.5	1215.7184	0.371	7.830408444	Rp	42,542.29
89	A300B4-100	133000	293214	2 Turbofan Engines	General Electric CF6-50C2	2	233.53	0	0	52500	0.75	268.4827146	5.2	62.5	1243.77344	0.371	8.011110178	Rp	43,524.04
90	A300B4-600	134000	295419	2 Turbofan Engines	Pratt & Whitney PW4158	2	258	0	0	58000	0.75	294.3959716	5.2	62.5	1253.12512	0.323	7.027073156	Rp	38,177.81
91	A300C4-600	136000	299828	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3	0	0	60100	0.75	300.5690312	5.2	62.5	1271.82848	0.34	7.507320889	Rp	40,786.97
92	A300F4-200	136000	299828	2 Turbofan Engines	General Electric CF6-50C1	2	233.53	0	0	52500	0.75	262.5603018	5.2	62.5	1271.82848	0.371	8.191811911	Rp	44,505.79
93	A300F4-600	140000	308646	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3	0	0	60100	0.75	291.9813446	5.2	62.5	1309.2352	0.34	7.728124444	Rp	41,986.59
94	A310-200	118500	261247	2 Turbofan Engines	General Electric CF6-80A2	2	222.411	0	0	50000	0.75	286.9857427	5.2	62.5	1108.17408	0.357	6.8683706	Rp	37,315.58
95	A310-300	123000	271168	2 Turbofan Engines	Pratt & Whitney PW4152	2	232.197	0	0	52200	0.75	288.65166	5.2	62.5	1150.25664	0.312	6.2305568	Rp	33,850.36
96	A318-100	57500	125766	2 Turbofan Engines	Pratt & Whitney PW6122	2	97.86	0	0	22000	0.75	260.2336805	5.2	62.5	537.7216	0.36	3.36076	Rp	18,258.87
97	A319-100	61000	134482	2 Turbofan Engines	CFM Intl. CFM56-5B5	2	97.86	0	0	22000	0.75	245.3022398	5.2	62.5	570.45248	0.32	3.169180444	Rp	17,218.03
98	A319-Neo	62800	138450	2 Turbofan Engines	IAE International Aero Engines V2524-A5	2	104.533	0	0	23500	0.75	254.5170532	5.2	62.5	587.285504	0.36	3.6705344	Rp	19,941.87
99	A320-200	64500	142198	2 Turbofan Engines	CFM Intl. CFM56-5A1	2	111.206	0	0	25000	0.75	263.6264381	5.2	62.5	603.18336	0.33	3.455738	Rp	18,774.89
100	A320-Neo	66300	146166	2 Turbofan Engines	IAE International Aero Engines V2527-A5	2	117.878	0	0	26500	0.75	271.8573088	5.2	62.5	620.016384	0.36	3.8751024	Rp	21,053.28
101	A321-100	75500	166449	2 Turbofan Engines	FM Intl. CFM56-5B1/P	2	133.447	0	0	30000	0.75	270.2607458	5.2	62.5	706.05184	0.35	4.290245556	Rp	23,308.73
102	A321-200	77800	171520	2 Turbofan Engines	FM Intl. CFM56-5B3/2P	2	142.3	0	0	32000	0.75	279.7557677	5.2	62.5	727.560704	0.36	4.5472544	Rp	24,705.05
103	A321-Neo	79200	174606	2 Turbofan Engines	IAE International Aero Engines V2533-A5	2	146.791	0	0	33000	0.75	283.398421	5.2	62.5	740.653056	0.37	4.7576672	Rp	25,848.21
104	A330-200	180000	396832	2 Turbofan Engines	General Electric CF6-80E1A2	2	300.255	0	0	67500	0.75	255.0585789	5.2	62.5	1683.3024	0.332	9.702368	Rp	52,712.58
105	A330-200F	182000	401241	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	256.3665716	5.2	62.5	1702.00576	0.323	9.544233689	Rp	51,853.44
106	A330-300	187000	412264	2 Turbofan Engines	Pratt & Whitney PW4164	2	284.686	0	0	64000	0.75	232.7807351	5.2	62.5	1748.76416	0.323	9.806437911	Rp	53,277.98
107	A330-800	186000	410060	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	250.853312	5.2	62.5	1739.41248	0.323	9.753997067	Rp	52,993.07
108	A330-900	191000	421083	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	244.2864713	5.2	62.5	1786.17088	0.323	10.01620129	Rp	54,417.62
109	A340-200	185000	407855	4 Turbofan Engines	CFM Intl. CFM56-5C2	4	138.785	0	0	31200	0.75	229.4148515	5.2	62.5	1730.0608	0.32	9.611448889	Rp	52,218.62
110	A340-300	192000	410060	4 Turbofan Engines	CFM Intl. CFM56-5C4	4	151.2	0	0	34000	0.75	240.8886578	5.2	62.5	1795.52256	0.33	10.286848	Rp	55,888.03
111	A340-500	246000	542337	4 Turbofan Engines	Rolls-Royce Trent 553-61	4	235.756	0	0	53000	0.75	293.0754402	5.2	62.5	2300.51328	0.45	17.97276	Rp	97,645.28
112	A340-600	265000	584225	4 Turbofan Engines	Rolls-Royce Trent 556-61	4	249.1	0	0	56000	0.75	287.4622474	5.2	62.5	2478.1952	0.45	19.3609	Rp	105,186.99
113	A350-900	205000	451948	2 Turbofan Engines	Trent XWB-84	2	373	0	0	84000	0.75	278.6981545	5.2	62.5	1917.0944	0.45	14.9773	Rp	81,371.07
114	A350-1000	233000	513677	2 Turbofan Engines	Trent XWB-97	2	431.5	0	0	97000	0.75	283.1551605	5.2	62.5	2178.94144	0.45	17.02298	Rp	92,485.17
115	A380-800	395000	870826	4 Turbofan engines	Engine Alliance GP7270	4	311.376	0	0	70000	0.75	241.0680239	5.2	62.5	3693.9136	0.38	24.36956889	Rp	132,398.89

116	BAE146-100A	35153	77499.1	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803	0	0	6700	0.75	259.2692862	5.2	62.5	328.739607	0.411	2.345694071	Rp	12,744.06
117	BAE146-200	36741	81000.04	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041	0	0	6970	0.75	258.0598669	5.2	62.5	343.5900749	0.408	2.43376303	Rp	13,222.54
118	BAE146-300	38329	84500.98	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617	0	0	7500	0.75	266.178172	5.2	62.5	358.4405427	0.415	2.582514327	Rp	14,030.70
119	Avro RJ70	37875	83500.08	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803	0	0	6700	0.75	240.6361246	5.2	62.5	354.19488	0.411	2.52732805	Rp	13,730.87
120	Avro RJ85	38556	85001.43	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041	0	0	6970	0.75	245.9118573	5.2	62.5	360.5633741	0.408	2.553990566	Rp	13,875.73
121	Avro RJ100	40143	88500.17	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617	0	0	7500	0.75	254.1499926	5.2	62.5	375.4044902	0.415	2.704737213	Rp	14,694.73
122	Bombardier Challenger 300	15308.74	33750	2 Turbofan engines	Honeywell HTF 7000 (AS907)	2	28.9134	0	0	6500	0.75	288.790235	5.2	62.5	143.1624618	0.42	1.043892951	Rp	5,671.43
123	Bombardier CL-600	16329.33	36000	2 Turbofan enginess	Avco Lycoming ALF502L	2	33.3617	0	0	7500	0.75	312.393283	5.2	62.5	152.7066259	0.428	1.134695068	Rp	6,164.75
124	Bombardier CL-601-3A	16329.33	36000	2 Turbofan enginess	General Electric CF34-3A	2	41.0126	0	0	9220	0.75	384.035476	5.2	62.5	152.7066259	0.357	0.946462942	Rp	5,142.10
125	Bombardier CL-601-3R	16329.33	36000	2 Turbofan enginess	General Electric CF34-3A	2	41.0126	0	0	9220	0.75	384.035476	5.2	62.5	152.7066259	0.357	0.946462942	Rp	5,142.10
126	Bombardier CL-604	17236.51	38000	2 Turbofan enginess	General Electric CF34-3B	2	41.0126	0	0	9220	0.75	363.8230825	5.2	62.5	161.1903274	0.346	0.968261341	Rp	5,260.52
127	Bombardier CL-605	17236.51	38000	2 Turbofan enginess	General Electric CF34-3B1	2	41.0126	0	0	9220	0.75	363.8230825	5.2	62.5	161.1903274	0.346	0.968261341	Rp	5,260.52
128	LEARJET-24D	5388.677	11880	2 Turbojet engines	General Electric CJ610-6	2	13.1	0	0	2950	0.75	372.3475495	5.2	62.5	50.39318655	0.98	0.857384077	Rp	4,658.13
129	LEARJET-25D	6032.779	13300	2 Turbojet engines	General Electric CJ610-8A	2	13.1	0	0	2950	0.75	332.5931495	5.2	62.5	56.41661458	0.98	0.959866012	Rp	5,214.91
130	LEARJET-31A	7257.478	16000	2 Turbofan engines	Garrett TFE731-2	2	15.6	0	0	3500	0.75	328.0129472	5.2	62.5	67.86961152	0.504	0.593859101	Rp	3,226.41
131	LEARJET-35A/-36A	6939.963	15300	2 Turbofan engines	Garrett TFE731-2-2B	2	15.6	0	0	3500	0.75	343.0200755	5.2	62.5	64.90031602	0.504	0.567877765	Rp	3,085.26
132	LEARJET-40	8708.974	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20AR	2	15.6	0	0	3500	0.75	273.3441227	5.2	62.5	81.44353382	0.441	0.623552056	Rp	3,387.73
133	LEARJET-45X	8708.974	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20BR	2	15.6	0	0	3500	0.75	273.3441227	5.2	62.5	81.44353382	0.441	0.623552056	Rp	3,387.73
134	LEARJET-55	8164.663	18000	2 Turbofan engines	Garrett TFE731-3A-2B	2	16.236	0	0	3650	0.75	304.0627955	5.2	62.5	76.35331296	0.515	0.68267285	Rp	3,708.93
135	Bombardier CRJ-100/-200	20276	44700	2 Turbofan engines	General Electric CF34-3A1	2	41.0126	0	0	9220	0.75	309.2838952	5.2	62.5	189.6146637	0.357	1.175215884	Rp	6,384.90
136	Bombardier CRJ-200LR	21319	47000	2 Turbofan engines	General Electric CF34-3B1	2	41.0126	0	0	9220	0.75	294.1526459	5.2	62.5	199.3684659	0.346	1.197595299	Rp	6,506.49
137	Bombardier CRJ700	30390	67000	2 Turbofan engines	General Electric CF34-8C1	2	60.9	0	0	13700	0.75	306.6186272	5.2	62.5	284.1975552	0.37	1.825574573	Rp	9,918.27
138	Bombardier CRJ1000	36968	81500	2 Turbofan engines	General Electric CF34-8C5A1	2	64.4992	0	0	14500	0.75	266.7784313	5.2	62.5	345.7129062	0.39	2.340764469	Rp	12,717.28
139	Dornier 328 Jet/-300	14390	31724	2 Turbofan engines	Pratt & Whitney Canada PW306B	2	26.9	0	0	6050	0.75	285.9586569	5.2	62.5	134.5706752	0.394	0.920500799	Rp	5,001.04
140	EMB135BJ	18500	40785	2 Turbofan engines	Allison / Rolls-Royce AE3007A1/3	2	32.0272	0	0	7200	0.75	264.709444	5.2	62.5	173.00608	0.36	1.081288	Rp	5,874.59
141	ERJ190-100LR	43000	94799	2 Turbofan engines	General Electric CF34-10E5	2	82.3	0	0	18500	0.75	292.6253463	5.2	62.5	402.12224	0.38	2.652889778	Rp	14,413.04
142	F-28 Fellowship	29030	64000	2 Turbofan engines	Rolls-Royce RB.183 Spey Mk.555-15P	2	44.0374	0	0	9900	0.75	231.9513084	5.2	62.5	271.4792704	0.75	3.534886333	Rp	19,204.90
143	F-70	36740	81000	2 Turbofan engines	Rolls-Royce Tay 620-15	2	616	0	0	13850	0.75	256.4007488	5.2	62.5	343.5807232	0.43	2.564925538	Rp	13,935.14
144	F-100	38780	88000	2 Turbofan engines	Rolls-Royce Tay 650-15	2	672	0	0	15100	0.75	264.8364821	5.2	62.5	362.6581504	0.43	2.707343831	Rp	14,708.89
145	Cessna Citation Sovereign	12508	27575	2 Turbofan engines	Pratt & Whitney Canada PW306C	2	25.2926	0	0	5686	0.75	309.1915743	5.2	62.5	116.9708134	0.394	0.800112856	Rp	4,346.98
146	Cessna Citation Longitude	15195	33500	2 Turbofan engines	Honeywell HTF7700L	2	33.81	0	0	7600	0.75	340.1900098	5.2	62.5	142.0987776	0.41	1.011466993	Rp	5,495.26
147	Cessna Citation CJ1+	4490.564	9900	2 Turbofan engines	Williams / Rolls-Royce FJ44-1AP	2	8.5	0	0	1900	0.75	287.7804789	5.2	62.5	41.99432213	0.456	0.33245505	Rp	1,806.21
148	Cessna Citation CJ1	4445.205	9800	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5	0	0	1900	0.75	290.7170144	5.2	62.5	41.57013706	0.456	0.329096918	Rp	1,787.97
149	Cessna Citation CJ2+	5227.652	11525	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447	0	0	3000	0.75	390.3221931	5.2	62.5	48.88732955	0.46	0.390419646	Rp	2,121.13
150	Cessna Citation CJ2	5216.312	11500	2 Turbofan engines	Williams / Rolls-Royce FJ44-2C	2	10.6757	0	0	2400	0.75	312.9365757	5.2	62.5	48.78128328	0.46	0.389572748	Rp	2,116.53
151	Cessna Citation CJ3	5783.303	12750	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447	0	0	3000	0.75	352.8206491	5.2	62.5	54.08359668	0.46	0.431917612	Rp	2,346.59
152	Cessna Citation Encore	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	357.2134983	5.2	62.5	64.47613094	0.394	0.441034646	Rp	2,396.12
153	Cessna Citation Encore+	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	357.2134983	5.2	62.5	64.47613094	0.394	0.441034646	Rp	2,396.12
154	Cessna Citation II/-IISP	6123.497	13500	2 Turbofan engines	Pratt & Whitney Canada JT15D-4	2	11.1	0	0	2500	0.75	277.6829183	5.2	62.5	57.26498472	0.562	0.558731275	Rp	3,035.56
155	Cessna Citation I/-ISP	5148.273	11350	2 Turbofan engines	Pratt & Whitney Canada JT15D-1A	2	9.8	0	0	2200	0.75	290.6496096	5.2	62.5	48.14500567	0.54	0.451359428	Rp	2,452.22
156	Cessna Citation Jet	4399.846	9700	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5	0	0	1900	0.75	293.7140971	5.2	62.5	41.14595198	0.456	0.325738787	Rp	1,769.73
157	Cessna Citation Mustang	3628.739	8000	2 Turbofan engines	Pratt & Whitney Canada PW615F	2	6.0051	0	0	1350	0.75	253.0385593	5.2	62.5	33.93480576	0.394	0.232123498	Rp	1,261.12
158	Cessna Citation S/II	6350.293	14000	2 Turbofan engines	Pratt & Whitney Canada JT15D-4B	2	11.1	0	0	2500	0.75	267.7656712	5.2	62.5	59.38591008	0.562	0.579425025	Rp	3,147.99
159	Cessna Citation Ultra	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	357.2134983	5.2	62.5	64.47613094	0.394	0.441034646	Rp	2,396.12
160	Cessna Citation V	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada JT15D-5A	2	12.8998	0	0	2900	0.75	286.0864803	5.2	62.5	64.47613094	0.551	0.616776878	Rp	3,350.92
161	Cessna Citation Excel	8482.177	18700	2 Turbofan engines	Pratt & Whitney Canada PW545A	2	16.8321	0	0	3784	0.75	303.4257582	5.2	62.5	79.32260846	0.394	0.542588676	Rp	2,947.86
162	Cessna Citation III	9071.847	20000	2 Turbofan engines	Garrett TFE731-3-100S	2	16.2	0	0	3650	0.75	273.656516	5.2	62.5	84.8370144	0.511	0.75263393	Rp	4,089.03
163	Cessna Citation VI	9071.847	20000	2 Turbofan engines	Garrett TFE731-3B-100	2	16.2	0	0	3650	0.75	273.656516	5.2	62.5	84.8370144	0.507	0.74674247	Rp	4,057.02
164	Cessna Citation VII	9071.847	20000	2 Turbofan engines	Garrett TFE731-4	2	18.1487	0	0	4080	0.75	305.8955028	5.2	62.5	84.8370144	0.517	0.761471119	Rp	4,137.04
165	Cessna Citation XLS	8482.177	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C	2	28.6554	0	0	6442	0.75	516.5615049	5.2	62.5	79.32260846	0.36	0.495766303	Rp	2,693.48
166	Cessna Citation XLS+	8482.177	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C1	2	30.0878	0	0	6764	0.75	542.3815615	5.2	62.5	79.32260846	0.36	0.495766303	Rp	2,693.48

b. Gradien 0,5° (g = 0,8 %)

No	Aircraft	MLW		Propulsion	engines	n	Power engines				Engine	V taxiing Calculated	V application	Time (s)	Resultant Force	SFC	Fuel Consumpstion	Biaya	
		Kg	Lbs			Engine	kN	kW	hp	lbf	efficiency				(lbf)	(lb/lbf/h)	(lb)		
1	DC-9-15	37059	81700	2 Turbofan Engines	Pratt & Whitney JT8D-7	2	62.3	0	0	14000	0.75	29.44429415	5.2	62.5023799	1061.927854	0.585	10.78561545	Rp	58,597.82
2	DC-9-21	43227	95300	2 Turbofan Engines	Pratt & Whitney JT8D-11	2	66.7	0	0	15000	0.75	27.04599548	5.2	62.5023799	1238.672261	0.62	13.33343829	Rp	72,440.03
3	DC-9-32	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-15	2	68.95	0	0	15500	0.75	26.90259256	5.2	62.5023799	1286.784106	0.62	13.85132856	Rp	75,253.71
4	DC-9-33F	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3	0	0	14500	0.75	25.16694143	5.2	62.5023799	1286.784106	0.565	12.62258167	Rp	68,577.98
5	DC-9-41	46266	102000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	26.95410012	5.2	62.5023799	1325.754987	0.6	13.81047365	Rp	75,031.75
6	DC-9-51	49895	110000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	24.9936546	5.2	62.5023799	1429.744199	0.6	14.89373584	Rp	80,917.07
7	DC-9-80	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	21.4787874	5.2	62.5023799	1663.71276	0.6	17.33100116	Rp	94,158.63
8	DC-8-61	108862	240000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	25.77466326	5.2	62.5023799	3119.447098	0.51	27.62115624	Rp	150,064.63
9	DC-8-63	117027	258000	4 Turbofan Engines	Pratt & Whitney JT3D-7	4	84.5	0	0	19000	0.75	25.30837919	5.2	62.5023799	3353.41566	0.52	30.27504415	Rp	164,483.10
10	DC-10-10	164881	363500	3 Turbofan Engines	General Electric CF6-6D	3	185	0	0	41500	0.75	29.42629274	5.2	62.5023799	4724.674882	0.35	28.71005515	Rp	155,980.58
11	DC-10-30	182798	403000	3 Turbofan Engines	General Electric CF6-50C	3	226	0	0	50800	0.75	32.49004701	5.2	62.5023799	5238.087584	0.394	35.83133845	Rp	194,670.22
12	DC-10-40	182798	403000	3 Turbofan Engines	Pratt and Whitney JT9D-20	3	219.7	0	0	49400	0.75	31.59465201	5.2	62.5023799	5238.087584	0.37	33.64871885	Rp	182,812.14
13	MD-11 -Passengger	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	36.37757152	5.2	62.5023799	5589.112065	0.322	31.24587872	Rp	169,757.60
14	MD-11 -Passengger-ER	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	36.37757152	5.2	62.5023799	5589.112065	0.322	31.24587872	Rp	169,757.60
15	MD-11-Combi	207749	458000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	34.1535823	5.2	62.5023799	5953.059976	0.322	33.28052612	Rp	180,811.76
16	MD-11-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	33.17579005	5.2	62.5023799	6128.514906	0.322	34.26140526	Rp	186,140.84
17	MD-11-Convertible-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	33.17579005	5.2	62.5023799	6128.514906	0.322	34.26140526	Rp	186,140.84
18	MD-81	58061	128000	2 Turbofan Engines	Pratt & Whitney JT8D-209	2	82.3	0	0	18500	0.75	24.83442019	5.2	62.5023799	1663.741415	0.51	14.73160472	Rp	80,036.22
19	MD-82	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217A	2	89	0	0	20000	0.75	26.4355147	5.2	62.5023799	1689.702899	0.53	15.54820551	Rp	84,472.78
20	MD-83	63276	139500	2 Turbofan Engines	Pratt & Whitney JT8D-219	2	93.4	0	0	21000	0.75	25.8670609	5.2	62.5023799	1813.177551	0.519	16.33810733	Rp	88,764.28
21	MD-87	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89	0	0	20000	0.75	26.84848425	5.2	62.5023799	1663.71276	0.5	14.44250097	Rp	78,465.53
22	MD-88	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89	0	0	20000	0.75	26.4355147	5.2	62.5023799	1689.702899	0.5	14.66811841	Rp	79,691.30
23	MD-90-30	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2525-D5	2	111.2	0	0	25000	0.75	30.25196001	5.2	62.5023799	1845.672389	0.35	11.21545025	Rp	60,933.09
24	MD-90-30ER	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2528-D5	2	124.5	0	0	28000	0.75	33.88219521	5.2	62.5023799	1845.672389	0.35	11.21545025	Rp	60,933.09
25	B707-120B	86300	190000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	32.51310999	5.2	62.5023799	2472.931643	0.51	21.89658268	Rp	118,963.25
26	B707-320	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	29.84980204	5.2	62.5023799	2693.575602	0.51	23.85027546	Rp	129,577.59
27	B707-420	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	29.84980204	5.2	62.5023799	2693.575602	0.51	23.85027546	Rp	129,577.59
28	B707-320B	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	29.84980204	5.2	62.5023799	2693.575602	0.51	23.85027546	Rp	129,577.59
29	B707-320C	112100	247000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	25.03016407	5.2	62.5023799	3212.232181	0.51	28.44272211	Rp	154,528.17
30	B717-200	49898	110000	2 Turbofan Engines	Rolls-Royce BR700-715C1-30	2	95.3	0	0	21430	0.75	33.47386347	5.2	62.5023799	1429.830164	0.37	9.185022665	Rp	49,901.86
31	B720	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3C-7	4	53.4	0	0	12000	0.75	23.52940371	5.2	62.5023799	2278.077238	0.785	31.04789457	Rp	168,681.96
32	B720B	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3D-1	4	75.62	0	0	17000	0.75	33.33332192	5.2	62.5023799	2278.077238	0.52	20.56675818	Rp	111,738.37
33	B727-100	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3	0	0	14500	0.75	26.20123659	5.2	62.5023799	1853.982356	0.565	18.18645691	Rp	98,806.29
34	B727-100C	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3	0	0	14500	0.75	26.20123659	5.2	62.5023799	1853.982356	0.565	18.18645691	Rp	98,806.29
35	B727-200	73100	161000	3 Turbofan Engines	Pratt & Whitney JT8D-17	3	71.2	0	0	16000	0.75	25.58943358	5.2	62.5023799	2094.684857	0.6	21.82046478	Rp	118,549.71
36	B737-100	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3	0	0	14500	0.75	25.16694143	5.2	62.5023799	1286.784106	0.565	12.62258167	Rp	68,577.98
37	B737-200	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	26.69217458	5.2	62.5023799	1338.764384	0.6	13.94599336	Rp	75,768.02
38	B737-200-Convertible-Ex	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	26.69217458	5.2	62.5023799	1338.764384	0.6	13.94599336	Rp	75,768.02
39	B737-200 Advanced	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	25.69453159	5.2	62.5023799	1390.744663	0.6	14.48747521	Rp	78,709.87
40	B737-200C/-200QC	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	25.69453159	5.2	62.5023799	1390.744663	0.6	14.48747521	Rp	78,709.87
41	B737-300	52889	116000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9	0	0	22000	0.75	32.42083032	5.2	62.5023799	1515.537447	0.39	10.2618422	Rp	55,752.18
42	B737-400	56245	124000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9	0	0	22000	0.75	30.48635959	5.2	62.5023799	1611.703827	0.39	10.91299353	Rp	59,289.86
43	B737-500	49895	110000	2 Turbofan Engines	CFM Intl. CFM56-3C1	2	104.5	0	0	23500	0.75	36.7094302	5.2	62.5023799	1429.744199	0.33	8.191554714	Rp	44,504.39
44	B737-600	51936	121500	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	33.01573658	5.2	62.5023799	1488.229175	0.36	9.301786529	Rp	50,536.23
45	B737-700/-Winglets/-700C	58604	129200	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	29.25918529	5.2	62.5023799	1679.301113	0.36	10.49603161	Rp	57,024.52
46	B737-800/-800 Winglets	66361	146300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	32.06391388	5.2	62.5023799	1901.57841	0.38	12.54561304	Rp	68,159.81
47	B737-900/-900 Winglets	66814	147300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	31.84652002	5.2	62.5023799	1914.559152	0.38	12.63125314	Rp	68,625.09
48	B737-900ER/-900ER Winglets	71350	157300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	29.82191155	5.2	62.5023799	2044.538502	0.38	13.48878845	Rp	73,284.05
49	B737-BBJ	60781	134000	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	28.21120572	5.2	62.5023799	1741.683177	0.36	10.88593436	Rp	59,142.84
50	B737-BBJ2	66360	146300	2 Turbofan Engines	CFM Intl. CFM56-7B26	2	117.4	0	0	26400	0.75	31.00732902	5.2	62.5023799	1901.549755	0.38	12.54542399	Rp	68,158.78
51	B737 Max-7	66043	145600	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	33.04441339	5.2	62.5023799	1892.466101	0.342	11.23694534	Rp	61,049.87
52	B737 Max-8/-200-/-BBJ8	69308	152800	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	31.4877387	5.2	62.5023799	1986.024871	0.342	11.79247169	Rp	64,068.03
53	B737 Max-9	74343	163900	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	29.35518063	5.2	62.5023799	2130.303096	0.342	12.64915627	Rp	68,722.36
54	B747-100/-100B	265300	585000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	28.20335612	5.2	62.5023799	7602.187311	0.367	48.43939205	Rp	263,169.27
55	B747-100SF	255800	584000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	29.25078334	5.2	62.5023799	7329.964245	0.367	46.70484918	Rp	253,745.57

56	B747-100B SR	273500	564000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	27.35777104	5.2	62.5023799	7837.1588	0.367	49.93657643	Rp	271,303.41
57	B747-200B/-200B Combi	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	27.27465663	5.2	62.5023799	8188.584451	0.343	48.76373988	Rp	264,931.44
58	B747-200C	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	27.27465663	5.2	62.5023799	8188.584451	0.343	48.76373988	Rp	264,931.44
59	B747-200F	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	27.27465663	5.2	62.5023799	8188.584451	0.343	48.76373988	Rp	264,931.44
60	B747-300	255800	564000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	32.29773994	5.2	62.5023799	7329.964245	0.373	47.46841619	Rp	257,894.00
61	B747-300SR	242630	535000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	34.05086707	5.2	62.5023799	6952.57711	0.373	45.02447936	Rp	244,616.19
62	B747-300	260320	574000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	31.73694636	5.2	62.5023799	7459.485115	0.373	48.3071857	Rp	262,451.00
63	B747-300 Combi	274380	605000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	30.1106563	5.2	62.5023799	7862.375253	0.373	50.91627848	Rp	276,626.10
64	B747-SP	204100	450000	4 Turbofan Engines	Pratt & Whitney JT9D-7FW	4	218.4	0	0	49100	0.75	37.50034742	5.2	62.5023799	5848.497664	0.367	37.26528427	Rp	202,460.79
65	B747-400 (CF6-80C2B1 engines)	285764	630000	4 Turbofan Engines	General Electric CF6-80C2B1F	4	254.3	0	0	57160	0.75	31.18038746	5.2	62.5023799	8188.584451	0.314	44.64085808	Rp	242,531.99
66	B747-8	312072	688000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8	0	0	66498	0.75	33.21624867	5.2	62.5023799	8942.441759	0.324	50.30315028	Rp	273,295.00
67	B747-8F	345184	761000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8	0	0	66498	0.75	30.02995839	5.2	62.5023799	9891.268092	0.324	55.64050164	Rp	302,292.61
68	B757-200/-200PF	92250	210000	2 Turbofan Engines	Rolls-Royce RB.211-535E4-37	2	189	0	0	42500	0.75	35.90784678	5.2	62.5023799	2643.429248	0.324	14.86985572	Rp	80,787.33
69	B757-300	101610	224000	2 Turbofan Engines	Pratt & Whitney PW2043	2	189.49	0	0	42600	0.75	32.6768328	5.2	62.5023799	2911.640606	0.35	17.69293432	Rp	96,125.00
70	B767-200	123377	272000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5	0	0	48000	0.75	30.32311686	5.2	62.5023799	3535.375288	0.343	21.05347047	Rp	114,382.66
71	B767-200ER	136078	300000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5	0	0	48000	0.75	27.49287313	5.2	62.5023799	3899.3232	0.343	23.22081226	Rp	126,157.74
72	B767-300	136078	300000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	34.36609141	5.2	62.5023799	3899.3232	0.33	22.34072317	Rp	121,376.25
73	B767-300ER	145150	320000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	32.2181811	5.2	62.5023799	4159.281901	0.33	23.8301266	Rp	129,468.12
74	B767-300ER Freighter	147871	326000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	31.62532874	5.2	62.5023799	4237.252318	0.33	24.27684913	Rp	131,895.15
75	B767-400ER	158757	350000	2 Turbofan Engines	General Electric CF6-80C2B8F	2	282.46	0	0	63500	0.75	31.17508526	5.2	62.5023799	4549.191297	0.323	25.51119342	Rp	138,601.29
76	B777-200 (GE engines)	208700	460000	2 Turbofan Engines	General Electric GE90-94B	2	416.798	0	0	93700	0.75	34.99322345	5.2	62.5023799	5980.310938	0.324	33.64052996	Rp	182,767.65
77	B777-200 (P & W engines/RR engines)	206350	455000	2 Turbofan Engines	Pratt & Whitney PW4077	2	343.4	0	0	77200	0.75	29.15947062	5.2	62.5023799	5912.971548	0.33	33.87768945	Rp	184,056.13
78	B777-300	237680	524000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	36.32094307	5.2	62.5023799	6810.734565	0.324	38.31184073	Rp	208,146.69
79	B777-200LR	223168	492000	2 Turbofan Engines	General Electric GE90-115B	2	513.9	0	0	115540	0.75	40.35220303	5.2	62.5023799	6394.89234	0.324	35.97263914	Rp	195,437.90
80	B777-300ER	251290	554000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	34.35378148	5.2	62.5023799	7200.729926	0.324	40.50564817	Rp	220,065.56
81	B777-F	260816	575000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	33.09904971	5.2	62.5023799	7473.698024	0.324	42.04115218	Rp	228,407.89
82	B777-9	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5	0	0	78129	0.75	22.87053944	5.2	62.5023799	7629.638858	0.45	59.6088233	Rp	323,852.34
83	B777-9X/-8X	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5	0	0	78129	0.75	22.87053944	5.2	62.5023799	7629.638858	0.45	59.6088233	Rp	323,852.34
84	B787-8	172365	380000	2 Turbofan Engines	General Electric GEnx-1B70	2	321.6	0	0	72300	0.75	32.69309389	5.2	62.5023799	4939.129348	0.45	38.58841736	Rp	209,649.32
85	B787-9	192778	425000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6	0	0	78129	0.75	31.58796175	5.2	62.5023799	5524.065079	0.45	43.15840177	Rp	234,477.86
86	B787-10	201848	445000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6	0	0	78129	0.75	30.16856293	5.2	62.5023799	5783.96647	0.45	45.1889587	Rp	245,509.80
87	A300B2-100	127500	281089	2 Turbofan Engines	General Electric CF6-50C	2	226.859	0	0	51000	0.75	31.17645991	5.2	62.5023799	3653.520099	0.394	24.99204396	Rp	135,780.77
88	A300B2-200	130000	286600	2 Turbofan Engines	General Electric CF6-50C2	2	233.53	0	0	52500	0.75	31.47623356	5.2	62.5023799	3725.157748	0.371	23.99455122	Rp	130,361.43
89	A300B4-100	133000	293214	2 Turbofan Engines	General Electric CF6-50C2	2	233.53	0	0	52500	0.75	30.76624333	5.2	62.5023799	3811.122927	0.371	24.54827163	Rp	133,369.77
90	A300B4-600	134000	295419	2 Turbofan Engines	Pratt & Whitney PW4158	2	258	0	0	58000	0.75	33.73572154	5.2	62.5023799	3839.777986	0.323	21.53290827	Rp	116,987.43
91	A300C4-600	136000	299828	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3	0	0	60100	0.75	34.44311104	5.2	62.5023799	3897.088105	0.34	23.00452101	Rp	124,982.64
92	A300F4-200	136000	299828	2 Turbofan Engines	General Electric CF6-50C1	2	233.53	0	0	52500	0.75	30.0875762	5.2	62.5023799	3897.088105	0.371	25.10199204	Rp	136,378.11
93	A300F4-600	140000	308646	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3	0	0	60100	0.75	33.45902215	5.2	62.5023799	4011.708344	0.34	23.68112457	Rp	128,658.60
94	A310-200	118500	261247	2 Turbofan Engines	General Electric CF6-80A2	2	222.411	0	0	50000	0.75	32.88656109	5.2	62.5023799	3395.624562	0.357	21.04659946	Rp	114,345.33
95	A310-300	123000	271168	2 Turbofan Engines	Pratt & Whitney PW4152	2	232.197	0	0	52200	0.75	33.07746356	5.2	62.5023799	3524.572331	0.312	19.09216043	Rp	103,726.94
96	A318-100	57500	125766	2 Turbofan Engines	Pratt & Whitney PW6122	2	97.86	0	0	22000	0.75	29.82096165	5.2	62.5023799	1647.665927	0.36	10.29830417	Rp	55,950.27
97	A319-100	61000	134482	2 Turbofan Engines	CFM Intl. CFM56-5B5	2	97.86	0	0	22000	0.75	28.10992287	5.2	62.5023799	1747.958635	0.32	9.711251083	Rp	52,760.84
98	A319-Neo	62800	138450	2 Turbofan Engines	IAE International Aero Engines V2524-A5	2	104.533	0	0	23500	0.75	29.16587611	5.2	62.5023799	1799.537743	0.36	11.24753916	Rp	61,107.43
99	A320-200	64500	142198	2 Turbofan Engines	CFM Intl. CFM56-5A1	2	111.206	0	0	25000	0.75	30.20974797	5.2	62.5023799	1848.251344	0.33	10.5893432	Rp	57,531.48
100	A320-Neo	66300	146166	2 Turbofan Engines	IAE International Aero Engines V2527-A5	2	117.878	0	0	26500	0.75	31.15294825	5.2	62.5023799	1899.830451	0.36	11.87439246	Rp	64,513.10
101	A321-100	75500	166449	2 Turbofan Engines	FM Intl. CFM56-5B1/P	2	133.447	0	0	30000	0.75	30.96999329	5.2	62.5023799	2163.457	0.35	13.14650665	Rp	71,424.44
102	A321-200	77800	171520	2 Turbofan Engines	FM Intl. CFM56-5B3/2P	2	142.3	0	0	32000	0.75	32.05805646	5.2	62.5023799	2229.363637	0.36	13.9340533	Rp	75,703.15
103	A321-Neo	79200	174606	2 Turbofan Engines	IAE International Aero Engines V2533-A5	2	146.791	0	0	33000	0.75	32.47547907	5.2	62.5023799	2269.48072	0.37	14.57881669	Rp	79,206.13
104	A330-200	180000	396832	2 Turbofan Engines	General Electric CF6-80E1A2	2	300.255	0	0	67500	0.75	29.22793117	5.2	62.5023799	5157.910728	0.332	29.73075639	Rp	161,526.01
105	A330-200F	182000	401241	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	29.37781799	5.2	62.5023799	5215.220847	0.323	29.24618884	Rp	158,893.37
106	A330-300	187000	412264	2 Turbofan Engines	Pratt & Whitney PW4164	2	284.686	0	0	64000	0.75	26.67504591	5.2	62.5023799	5358.496145	0.323	30.04965557	Rp	163,258.57
107	A330-800	186000	410060	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	28.74603696	5.2	62.5023799	5329.841085	0.323	29.88896222	Rp	162,385.53
108	A330-900	191000	421083	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	27.9935229	5.2	62.5023799	5473.116383	0.323	30.69242895	Rp	166,750.73
109	A340-200	185000	407855	4 Turbofan Engines	CFM Intl. CFM56-5C2	4	138.785	0	0	31200	0.75	26.28933917	5.2	62.5023799	5301.186026	0.32	29.45215492	Rp	160,012.38
110	A340-300	192000	410060	4 Turbofan Engines	CFM Intl. CFM56-5C4	4	151.2	0	0	34000	0.75	27.60415721	5.2	62.5023799	5501.771443	0.33	31.52176581	Rp	171,256.49
111	A340-500	246000	542337	4 Turbofan Engines	Rolls-Royce Trent 553-61	4	235.756	0	0	53000	0.75	33.58439787	5.2	62.5023799	7049.144661	0.45	55.0735397	Rp	299,212.33
112	A340-600	265000	584225	4 Turbofan Engines	Rolls-Royce Trent 556-61	4	249.1	0	0	56000	0.75	32.94116519	5.2	62.5023799	7593.590794	0.45	59.32718707	Rp	322,322.23
113	A350-900	205000	451948	2 Turbofan Engines	Trent XWB-84	2	373	0	0	84000	0.75	31.93686137	5.2	62.5023799	5874.287218	0.45	45.89461641	Rp	249,343.61
114	A350-1000	233000	513677	2 Turbofan Engines	Trent XWB-97	2	431.5	0	0	97000	0.75	32.44760312	5.2	62.5023799	6676.628886	0.45	52.16314939	Rp	283,400.30
115	A380-800	395000	870826	4 Turbofan engines	Engine Alliance GP7270	4	311.376	0	0	70000	0.75	27.62471131	5.2	62.5023799	11318.74854	0.38	74.6751428	Rp	405,707.05

116	BAE146-100A	35153	77499.1	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803	0	0	6700	0.75	29.71044881	5.2	62.5023799	1007.31131	0.411	7.187859602	Rp	39,051.35
117	BAE146-200	36741	81000.04	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041	0	0	6970	0.75	29.57185781	5.2	62.5023799	1052.815545	0.408	7.457727409	Rp	40,517.53
118	BAE146-300	38329	84500.98	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617	0	0	7500	0.75	30.50215885	5.2	62.5023799	1098.319779	0.415	7.913542789	Rp	42,993.96
119	Avro RJ70	37875	83500.08	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803	0	0	6700	0.75	27.57521867	5.2	62.5023799	1085.310382	0.411	7.744436675	Rp	42,075.21
120	Avro RJ85	38556	85001.43	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041	0	0	6970	0.75	28.17978078	5.2	62.5023799	1104.824478	0.408	7.826138047	Rp	42,519.09
121	Avro RJ100	40143	88500.17	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617	0	0	7500	0.75	29.12381353	5.2	62.5023799	1150.300057	0.415	8.288067734	Rp	45,028.74
122	Bombardier Challenger 300	15308.74	33750	2 Turbofan engines	Honeywell HTF 7000 (AS907)	2	28.9134	0	0	6500	0.75	33.09334329	5.2	62.5023799	438.672931	0.42	3.198778588	Rp	17,378.84
123	Bombardier CL-600	16329.33	36000	2 Turbofan enginess	Avco Lycoming ALF502L	2	33.3617	0	0	7500	0.75	35.7980877	5.2	62.5023799	467.917793	0.428	3.477021551	Rp	18,890.52
124	Bombardier CL-601-3A	16329.33	36000	2 Turbofan enginess	General Electric CF34-3A	2	41.0126	0	0	9220	0.75	44.00778247	5.2	62.5023799	467.917793	0.357	2.90022592	Rp	15,756.81
125	Bombardier CL-601-3R	16329.33	36000	2 Turbofan enginess	General Electric CF34-3A	2	41.0126	0	0	9220	0.75	44.00778247	5.2	62.5023799	467.917793	0.357	2.90022592	Rp	15,756.81
126	Bombardier CL-604	17236.51	38000	2 Turbofan enginess	General Electric CF34-3B	2	41.0126	0	0	9220	0.75	41.6915834	5.2	62.5023799	493.913226	0.346	2.967022284	Rp	16,119.71
127	Bombardier CL-605	17236.51	38000	2 Turbofan enginess	General Electric CF34-3B1	2	41.0126	0	0	9220	0.75	41.6915834	5.2	62.5023799	493.913226	0.346	2.967022284	Rp	16,119.71
128	LEARJET-24D	5388.677	11880	2 Turbojet engines	General Electric CJ610-6	2	13.1	0	0	2950	0.75	42.66842776	5.2	62.5023799	154.4128717	0.98	2.62726348	Rp	14,273.82
129	LEARJET-25D	6032.779	13300	2 Turbojet engines	General Electric CJ610-8A	2	13.1	0	0	2950	0.75	38.11285126	5.2	62.5023799	172.8696291	0.98	2.941296657	Rp	15,979.95
130	LEARJET-31A	7257.478	16000	2 Turbofan engines	Garrett TFE731-2	2	15.6	0	0	3500	0.75	37.58799208	5.2	62.5023799	207.9634636	0.504	1.819749597	Rp	9,886.63
131	LEARJET-35A/-36A	6939.963	15300	2 Turbofan engines	Garrett TFE731-2-2B	2	15.6	0	0	3500	0.75	39.30770414	5.2	62.5023799	198.865062	0.504	1.740135552	Rp	9,454.09
132	LEARJET-40	8708.974	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20AR	2	15.6	0	0	3500	0.75	31.32332673	5.2	62.5023799	249.5561563	0.441	1.910737077	Rp	10,380.96
133	LEARJET-45X	8708.974	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20BR	2	15.6	0	0	3500	0.75	31.32332673	5.2	62.5023799	249.5561563	0.441	1.910737077	Rp	10,380.96
134	LEARJET-55	8164.663	18000	2 Turbofan engines	Garrett TFE731-3A-2B	2	16.236	0	0	3650	0.75	34.84347202	5.2	62.5023799	233.9588965	0.515	2.091899648	Rp	11,365.21
135	Bombardier CRJ-100/-200	20276	44700	2 Turbofan engines	General Electric CF34-3A1	2	41.0126	0	0	9220	0.75	35.44177357	5.2	62.5023799	581.0099884	0.357	3.601188613	Rp	19,565.11
136	Bombardier CRJ-200LR	21319	47000	2 Turbofan engines	General Electric CF34-3B1	2	41.0126	0	0	9220	0.75	33.70783812	5.2	62.5023799	610.8972156	0.346	3.669765369	Rp	19,937.69
137	Bombardier CRJ700	30390	67000	2 Turbofan engines	General Electric CF34-8C1	2	60.9	0	0	13700	0.75	35.13635248	5.2	62.5023799	870.8272612	0.37	5.594068676	Rp	30,392.35
138	Bombardier CRJ1000	36968	81500	2 Turbofan engines	General Electric CF34-8C5A1	2	64.4992	0	0	14500	0.75	30.57094438	5.2	62.5023799	1059.320243	0.39	7.17275393	Rp	38,969.28
139	Dornier 328 Jet/-300	14390	31724	2 Turbofan engines	Pratt & Whitney Canada PW306B	2	26.9	0	0	6050	0.75	32.76886422	5.2	62.5023799	412.3463076	0.394	2.820670687	Rp	15,324.59
140	EMB135BJ	18500	40785	2 Turbofan engines	Allison / Rolls-Royce AE3007A1/3	2	32.0272	0	0	7200	0.75	30.33385288	5.2	62.5023799	530.1186026	0.36	3.313367429	Rp	18,001.39
141	ERJ190-100LR	43000	94799	2 Turbofan engines	General Electric CF34-10E5	2	82.3	0	0	18500	0.75	33.53282025	5.2	62.5023799	1232.167563	0.38	8.129192761	Rp	44,165.58
142	F-28 Fellowship	29030	64000	2 Turbofan engines	Rolls-Royce RB.183 Spey Mk.555-15P	2	44.0374	0	0	9900	0.75	26.57999941	5.2	62.5023799	831.8563801	0.75	10.83187573	Rp	58,849.15
143	F-70	36740	81000	2 Turbofan engines	Rolls-Royce Tay 620-15	2	616	0	0	13850	0.75	29.38173447	5.2	62.5023799	1052.78689	0.43	7.859645843	Rp	42,701.14
144	F-100	38780	88000	2 Turbofan engines	Rolls-Royce Tay 650-15	2	672	0	0	15100	0.75	30.34841056	5.2	62.5023799	1111.243211	0.43	8.296055139	Rp	45,072.13
145	Cessna Citation Sovereign	12508	27575	2 Turbofan engines	Pratt & Whitney Canada PW306C	2	25.2926	0	0	5686	0.75	35.43119424	5.2	62.5023799	358.4174855	0.394	2.451768517	Rp	13,320.36
146	Cessna Citation Longitude	15195	33500	2 Turbofan engines	Honeywell HTF7700L	2	33.81	0	0	7600	0.75	38.98339837	5.2	62.5023799	435.4136306	0.41	3.099416428	Rp	16,839.01
147	Cessna Citation CJ1+	4490.564	9900	2 Turbofan engines	Williams / Rolls-Royce FJ44-1AP	2	8.5	0	0	1900	0.75	32.9776323	5.2	62.5023799	128.6773931	0.456	1.018734819	Rp	5,534.75
148	Cessna Citation CJ1	4445.205	9800	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5	0	0	1900	0.75	33.31413875	5.2	62.5023799	127.3776214	0.456	1.008444568	Rp	5,478.84
149	Cessna Citation CJ2+	5227.652	11525	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447	0	0	3000	0.75	44.72819634	5.2	62.5023799	149.7986824	0.46	1.196354475	Rp	6,499.75
150	Cessna Citation CJ2	5216.312	11500	2 Turbofan engines	Williams / Rolls-Royce FJ44-2C	2	10.6757	0	0	2400	0.75	35.86034524	5.2	62.5023799	149.4737394	0.46	1.193759346	Rp	6,485.65
151	Cessna Citation CJ3	5783.303	12750	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447	0	0	3000	0.75	40.4307814	5.2	62.5023799	165.720885	0.46	1.323515797	Rp	7,190.61
152	Cessna Citation Encore	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	40.93417122	5.2	62.5023799	197.5652904	0.394	1.351452925	Rp	7,342.39
153	Cessna Citation Encore+	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	40.93417122	5.2	62.5023799	197.5652904	0.394	1.351452925	Rp	7,342.39
154	Cessna Citation II/-IISP	6123.497	13500	2 Turbofan engines	Pratt & Whitney Canada JT15D-4	2	11.1	0	0	2500	0.75	31.8205224	5.2	62.5023799	175.4691724	0.562	1.712108159	Rp	9,301.81
155	Cessna Citation I/-ISP	5148.273	11350	2 Turbofan engines	Pratt & Whitney Canada JT15D-1A	2	9.8	0	0	2200	0.75	33.30641463	5.2	62.5023799	147.524082	0.54	1.383090932	Rp	7,514.28
156	Cessna Citation Jet	4399.846	9700	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5	0	0	1900	0.75	33.65758348	5.2	62.5023799	126.0778498	0.456	0.998154317	Rp	5,422.93
157	Cessna Citation Mustang	3628.739	8000	2 Turbofan engines	Pratt & Whitney Canada PW615F	2	6.0051	0	0	1350	0.75	28.99645103	5.2	62.5023799	103.9817318	0.394	0.711291013	Rp	3,864.42
158	Cessna Citation S/II	6350.293	14000	2 Turbofan engines	Pratt & Whitney Canada JT15D-4B	2	11.1	0	0	2500	0.75	30.68407517	5.2	62.5023799	181.9680306	0.562	1.775519572	Rp	9,646.33
159	Cessna Citation Ultra	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	40.93417122	5.2	62.5023799	197.5652904	0.394	1.351452925	Rp	7,342.39
160	Cessna Citation V	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada JT15D-5A	2	12.8998	0	0	2900	0.75	32.78351189	5.2	62.5023799	197.5652904	0.551	1.889976044	Rp	10,268.16
161	Cessna Citation Excel	8482.177	18700	2 Turbofan engines	Pratt & Whitney Canada PW545A	2	16.8321	0	0	3784	0.75	34.770472	5.2	62.5023799	243.057298	0.394	1.662642743	Rp	9,033.07
162	Cessna Citation III	9071.847	20000	2 Turbofan engines	Garrett TFE731-3-100S	2	16.2	0	0	3650	0.75	31.35912482	5.2	62.5023799	259.9543295	0.511	2.306279871	Rp	12,529.93
163	Cessna Citation VI	9071.847	20000	2 Turbofan engines	Garrett TFE731-3B-100	2	16.2	0	0	3650	0.75	31.35912482	5.2	62.5023799	259.9543295	0.507	2.288226799	Rp	12,431.84
164	Cessna Citation VII	9071.847	20000	2 Turbofan engines	Garrett TFE731-4	2	18.1487	0	0	4080	0.75	35.05348747	5.2	62.5023799	259.9543295	0.517	2.333359478	Rp	12,677.05
165	Cessna Citation XLS	8482.177	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C	2	28.6554	0	0	6442	0.75	59.19433949	5.2	62.5023799	243.057298	0.36	1.519165958	Rp	8,253.57
166	Cessna Citation XLS+	8482.177	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C1	2	30.0878	0	0	6764	0.75	62.15313758	5.2	62.5023799	243.057298	0.36	1.519165958	Rp	8,253.57

c. Gradien 1° (g = 1,75 %)

No	Aircraft	MLW		Propulsion	engines	n	Power engines				Engine	V taxiing Calculated	V application	Time (s)	Resultant Force	SFC	Fuel Consumpstion	Biaya	
		Kg	Lbs			Engine	kN	kW	hp	lbf	efficiency				(lbf)	(lb/lbf/h)	(lb)		
1	DC-9-15	37059	81700	2 Turbofan Engines	Pratt & Whitney JT8D-7	2	62.3	0	0	14000	0.75	14.72270767	5.2	62.5095205	1777.210427	0.585	18.05254289	Rp	98,078.74
2	DC-9-21	43227	95300	2 Turbofan Engines	Pratt & Whitney JT8D-11	2	66.7	0	0	15000	0.75	13.52351267	5.2	62.5095205	2073.004537	0.62	22.31698948	Rp	121,247.31
3	DC-9-32	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-15	2	68.95	0	0	15500	0.75	13.45180848	5.2	62.5095205	2153.52307	0.62	23.18381405	Rp	125,956.73
4	DC-9-33F	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3	0	0	14500	0.75	12.58394987	5.2	62.5095205	2153.52307	0.565	21.12718538	Rp	114,783.15
5	DC-9-41	46266	102000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	13.47756325	5.2	62.5095205	2218.743561	0.6	23.11543268	Rp	125,585.22
6	DC-9-51	49895	110000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	12.49730316	5.2	62.5095205	2392.776768	0.6	24.92855474	Rp	135,435.84
7	DC-9-80	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	10.73980264	5.2	62.5095205	2784.339496	0.6	29.00795447	Rp	157,599.05
8	DC-8-61	108862	240000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	12.88782236	5.2	62.5095205	5220.612577	0.51	46.2312151	Rp	251,172.34
9	DC-8-63	117027	258000	4 Turbofan Engines	Pratt & Whitney JT3D-7	4	84.5	0	0	19000	0.75	12.65467145	5.2	62.5095205	5612.175305	0.52	50.67318928	Rp	275,305.40
10	DC-10-10	164881	363500	3 Turbofan Engines	General Electric CF6-6D	3	185	0	0	41500	0.75	14.71370662	5.2	62.5095205	7907.07338	0.35	48.05377165	Rp	261,074.21
11	DC-10-30	182798	403000	3 Turbofan Engines	General Electric CF6-50C	3	226	0	0	50800	0.75	16.24564209	5.2	62.5095205	8766.305395	0.394	59.97309818	Rp	325,831.43
12	DC-10-40	182798	403000	3 Turbofan Engines	Pratt and Whitney JT9D-20	3	219.7	0	0	49400	0.75	15.79792754	5.2	62.5095205	8766.305395	0.37	56.31991453	Rp	305,983.83
13	MD-11 -Passengger	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	18.18947836	5.2	62.5095205	9353.769377	0.322	52.29813435	Rp	284,133.66
14	MD-11 -Passengger-ER	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	18.18947836	5.2	62.5095205	9353.769377	0.322	52.29813435	Rp	284,133.66
15	MD-11-Combi	207749	458000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	17.07744141	5.2	62.5095205	9962.861626	0.322	55.70364788	Rp	302,635.68
16	MD-11-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	16.58852667	5.2	62.5095205	10256.4977	0.322	57.34540518	Rp	311,555.28
17	MD-11-Convertible-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	16.58852667	5.2	62.5095205	10256.4977	0.322	57.34540518	Rp	311,555.28
18	MD-81	58061	128000	2 Turbofan Engines	Pratt & Whitney JT8D-209	2	82.3	0	0	18500	0.75	12.41768292	5.2	62.5095205	2784.387452	0.51	24.65718598	Rp	133,961.50
19	MD-82	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217A	2	89	0	0	20000	0.75	13.21826066	5.2	62.5095205	2827.835809	0.53	26.02398057	Rp	141,387.24
20	MD-83	63276	139500	2 Turbofan Engines	Pratt & Whitney JT8D-219	2	93.4	0	0	21000	0.75	12.93402294	5.2	62.5095205	3034.479262	0.519	27.34608746	Rp	148,570.20
21	MD-87	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89	0	0	20000	0.75	13.4247533	5.2	62.5095205	2784.339496	0.5	24.17329539	Rp	131,332.54
22	MD-88	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89	0	0	20000	0.75	13.21826066	5.2	62.5095205	2827.835809	0.5	24.55092507	Rp	133,384.19
23	MD-90-30	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2525-D5	2	111.2	0	0	25000	0.75	15.12655598	5.2	62.5095205	3088.861642	0.35	18.77198363	Rp	101,987.43
24	MD-90-30ER	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2528-D5	2	124.5	0	0	28000	0.75	16.9417427	5.2	62.5095205	3088.861642	0.35	18.77198363	Rp	101,987.43
25	B707-120B	86300	190000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	16.25717402	5.2	62.5095205	4138.623812	0.51	36.64964692	Rp	199,116.06
26	B707-320	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	14.92546934	5.2	62.5095205	4507.886887	0.51	39.91966177	Rp	216,881.92
27	B707-420	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	14.92546934	5.2	62.5095205	4507.886887	0.51	39.91966177	Rp	216,881.92
28	B707-320B	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	14.92546934	5.2	62.5095205	4507.886887	0.51	39.91966177	Rp	216,881.92
29	B707-320C	112100	247000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	12.51555859	5.2	62.5095205	5375.894894	0.51	47.60632004	Rp	258,643.23
30	B717-200	49898	110000	2 Turbofan Engines	Rolls-Royce BR700-715C1-30	2	95.3	0	0	21430	0.75	16.73756905	5.2	62.5095205	2392.920637	0.37	15.37353305	Rp	83,523.79
31	B720	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3C-7	4	53.4	0	0	12000	0.75	11.76514983	5.2	62.5095205	3812.521356	0.785	51.96675619	Rp	282,333.30
32	B720B	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3D-1	4	75.62	0	0	17000	0.75	16.6672956	5.2	62.5095205	3812.521356	0.52	34.42383849	Rp	187,023.33
33	B727-100	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3	0	0	14500	0.75	13.10111715	5.2	62.5095205	3102.768953	0.565	30.43978297	Rp	165,378.12
34	B727-100C	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3	0	0	14500	0.75	13.10111715	5.2	62.5095205	3102.768953	0.565	30.43978297	Rp	165,378.12
35	B727-200	73100	161000	3 Turbofan Engines	Pratt & Whitney JT8D-17	3	71.2	0	0	16000	0.75	12.79520399	5.2	62.5095205	3505.601398	0.6	36.52224374	Rp	198,423.88
36	B737-100	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3	0	0	14500	0.75	12.58394987	5.2	62.5095205	2153.52307	0.565	21.12718538	Rp	114,783.15
37	B737-200	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	13.34659549	5.2	62.5095205	2240.515695	0.6	23.3422603	Rp	126,817.56
38	B737-200-Convertible-Ex	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	13.34659549	5.2	62.5095205	2240.515695	0.6	23.3422603	Rp	126,817.56
39	B737-200 Advanced	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	12.847755	5.2	62.5095205	2327.508321	0.6	24.24857152	Rp	131,741.52
40	B737-200C/-200QC	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	12.847755	5.2	62.5095205	2327.508321	0.6	24.24857152	Rp	131,741.52
41	B737-300	52889	116000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9	0	0	22000	0.75	16.21103243	5.2	62.5095205	2536.357761	0.39	17.17587164	Rp	93,315.82
42	B737-400	56245	124000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9	0	0	22000	0.75	15.24376023	5.2	62.5095205	2697.298914	0.39	18.26574336	Rp	99,237.05
43	B737-500	49895	110000	2 Turbofan Engines	CFM Intl. CFM56-3C1	2	104.5	0	0	23500	0.75	18.35541402	5.2	62.5095205	2392.776768	0.33	13.71070511	Rp	74,489.71
44	B737-600	51936	121500	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	16.50849688	5.2	62.5095205	2490.655461	0.36	15.56896786	Rp	84,585.58
45	B737-700/-Winglets/-700C	58604	129200	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	14.63014972	5.2	62.5095205	2810.427693	0.36	17.56784875	Rp	95,445.42
46	B737-800/-800 Winglets	66361	146300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	16.03256741	5.2	62.5095205	3182.424273	0.38	20.99835829	Rp	114,083.24
47	B737-900/-900 Winglets	66814	147300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	15.92386634	5.2	62.5095205	3204.148452	0.38	21.14169935	Rp	114,862.00
48	B737-900ER/-900ER Winglets	71350	157300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	14.91152356	5.2	62.5095205	3421.677972	0.38	22.57700854	Rp	122,659.98
49	B737-BBJ	60781	134000	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	14.10613998	5.2	62.5095205	2914.828435	0.36	18.22045278	Rp	98,990.99
50	B737-BBJ2	66360	146300	2 Turbofan Engines	CFM Intl. CFM56-7B26	2	117.4	0	0	26400	0.75	15.50425487	5.2	62.5095205	3182.376317	0.38	20.99804186	Rp	114,081.52
51	B737 Max-7	66043	145600	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	16.52283584	5.2	62.5095205	3167.174188	0.342	18.80796128	Rp	102,182.90
52	B737 Max-8/-200-/-BBJ8	69308	152800	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	15.74446885	5.2	62.5095205	3323.751323	0.342	19.73777964	Rp	107,234.56
53	B737 Max-9	74343	163900	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	14.67814921	5.2	62.5095205	3565.211009	0.342	21.17166491	Rp	115,024.81
54	B747-100/-100B	265300	585000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	14.10221503	5.2	62.5095205	12722.79139	0.367	81.07596704	Rp	440,482.47
55	B747-100SF	255800	584000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	14.62594858	5.2	62.5095205	12267.20708	0.367	78.17275676	Rp	424,709.45

56	B747-100B SR	273500	564000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	13.67940639	5.2	62.5095205	13116.03259	0.367	83.58189591	Rp	454,097.08
57	B747-200B/-200B Combi	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	13.6378476	5.2	62.5095205	13704.16796	0.343	81.61884779	Rp	443,431.92
58	B747-200C	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	13.6378476	5.2	62.5095205	13704.16796	0.343	81.61884779	Rp	443,431.92
59	B747-200F	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	13.6378476	5.2	62.5095205	13704.16796	0.343	81.61884779	Rp	443,431.92
60	B747-300	255800	564000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	16.14948489	5.2	62.5095205	12267.20708	0.373	79.45078548	Rp	431,652.93
61	B747-300SR	242630	535000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	17.02608183	5.2	62.5095205	11635.62335	0.373	75.36021924	Rp	409,429.05
62	B747-300	260320	574000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	15.86907743	5.2	62.5095205	12483.9693	0.373	80.85468521	Rp	439,280.26
63	B747-300 Combi	274380	605000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	15.05590143	5.2	62.5095205	13158.23408	0.373	85.22168304	Rp	463,005.98
64	B747-SP	204100	450000	4 Turbofan Engines	Pratt & Whitney JT9D-7FW	4	218.4	0	0	49100	0.75	18.75088768	5.2	62.5095205	9787.869293	0.367	62.37318083	Rp	338,870.99
65	B747-400 (CF6-80C2B1 engines)	285764	630000	4 Turbofan Engines	General Electric CF6-80C2B1F	4	254.3	0	0	57160	0.75	15.59078738	5.2	62.5095205	13704.16796	0.314	74.71812888	Rp	405,940.59
66	B747-8	312072	688000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8	0	0	66498	0.75	16.60875675	5.2	62.5095205	14965.80081	0.324	84.19545295	Rp	457,430.52
67	B747-8F	345184	761000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8	0	0	66498	0.75	15.01555094	5.2	62.5095205	16553.72795	0.324	93.12890369	Rp	505,965.59
68	B757-200/-200PF	92250	210000	2 Turbofan Engines	Rolls-Royce RB.211-535E4-37	2	189	0	0	42500	0.75	17.95460705	5.2	62.5095205	4423.963461	0.324	24.88858512	Rp	135,218.68
69	B757-300	101610	224000	2 Turbofan Engines	Pratt & Whitney PW2043	2	189.49	0	0	42600	0.75	16.33903854	5.2	62.5095205	4872.8339	0.35	29.61374408	Rp	160,890.28
70	B767-200	123377	272000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5	0	0	48000	0.75	15.16213576	5.2	62.5095205	5916.697451	0.343	35.23847855	Rp	191,449.24
71	B767-200ER	136078	300000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5	0	0	48000	0.75	13.74696	5.2	62.5095205	6525.7897	0.343	38.8660908	Rp	211,157.91
72	B767-300	136078	300000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	17.18370001	5.2	62.5095205	6525.7897	0.33	37.39303196	Rp	203,154.84
73	B767-300ER	145150	320000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	16.10970396	5.2	62.5095205	6960.84874	0.33	39.8859374	Rp	216,698.70
74	B767-300ER Freighter	147871	326000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	15.81326649	5.2	62.5095205	7091.337679	0.33	40.63364415	Rp	220,760.96
75	B767-400ER	158757	350000	2 Turbofan Engines	General Electric CF6-80C2B8F	2	282.46	0	0	63500	0.75	15.58813618	5.2	62.5095205	7613.389345	0.323	42.69964153	Rp	231,985.44
76	B777-200 (GE engines)	208700	460000	2 Turbofan Engines	General Electric GE90-94B	2	416.798	0	0	93700	0.75	17.49727797	5.2	62.5095205	10008.46801	0.324	56.30620828	Rp	305,909.37
77	B777-200 (P & W engines/RR engines)	206350	455000	2 Turbofan Engines	Pratt & Whitney PW4077	2	343.4	0	0	77200	0.75	14.58029048	5.2	62.5095205	9895.770841	0.33	56.70315661	Rp	308,065.97
78	B777-300	237680	524000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	18.16116306	5.2	62.5095205	11398.23995	0.324	64.12486624	Rp	348,387.82
79	B777-200LR	223168	492000	2 Turbofan Engines	General Electric GE90-115B	2	513.9	0	0	115540	0.75	20.17686979	5.2	62.5095205	10702.29894	0.324	60.20960177	Rp	327,116.35
80	B777-300ER	251290	554000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	17.17754481	5.2	62.5095205	12050.92442	0.324	67.79677566	Rp	368,337.16
81	B777-F	260816	575000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	16.55015503	5.2	62.5095205	12507.7556	0.324	70.36684245	Rp	382,300.23
82	B777-9	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5	0	0	78129	0.75	11.43570516	5.2	62.5095205	12768.73348	0.45	99.77092587	Rp	542,051.43
83	B777-9X/-8X	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5	0	0	78129	0.75	11.43570516	5.2	62.5095205	12768.73348	0.45	99.77092587	Rp	542,051.43
84	B787-8	172365	380000	2 Turbofan Engines	General Electric GEnx-1B70	2	321.6	0	0	72300	0.75	16.3471694	5.2	62.5095205	8265.977907	0.45	64.58778943	Rp	350,902.87
85	B787-9	192778	425000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6	0	0	78129	0.75	15.79458229	5.2	62.5095205	9244.908705	0.45	72.23685128	Rp	392,459.91
86	B787-10	201848	445000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6	0	0	78129	0.75	15.08485585	5.2	62.5095205	9679.871833	0.45	75.63551835	Rp	410,924.73
87	A300B2-100	127500	281089	2 Turbofan Engines	General Electric CF6-50C	2	226.859	0	0	51000	0.75	15.58882353	5.2	62.5095205	6114.421043	0.394	41.8307094	Rp	227,264.56
88	A300B2-200	130000	286600	2 Turbofan Engines	General Electric CF6-50C2	2	233.53	0	0	52500	0.75	15.73871606	5.2	62.5095205	6234.311652	0.371	40.16114491	Rp	218,193.89
89	A300B4-100	133000	293214	2 Turbofan Engines	General Electric CF6-50C2	2	233.53	0	0	52500	0.75	15.38370743	5.2	62.5095205	6378.180382	0.371	41.08794056	Rp	223,229.13
90	A300B4-600	134000	295419	2 Turbofan Engines	Pratt & Whitney PW4158	2	258	0	0	58000	0.75	16.86850307	5.2	62.5095205	6426.136626	0.323	36.04094286	Rp	195,809.00
91	A300C4-600	136000	299828	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3	0	0	60100	0.75	17.22221129	5.2	62.5095205	6522.049113	0.34	38.50407092	Rp	209,191.07
92	A300F4-200	136000	299828	2 Turbofan Engines	General Electric CF6-50C1	2	233.53	0	0	52500	0.75	15.04436094	5.2	62.5095205	6522.049113	0.371	42.01473621	Rp	228,264.37
93	A300F4-600	140000	308646	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3	0	0	60100	0.75	16.73014811	5.2	62.5095205	6713.874087	0.34	39.6365436	Rp	215,343.75
94	A310-200	118500	261247	2 Turbofan Engines	General Electric CF6-80A2	2	222.411	0	0	50000	0.75	16.44390668	5.2	62.5095205	5682.814852	0.357	35.22697812	Rp	191,386.76
95	A310-300	123000	271168	2 Turbofan Engines	Pratt & Whitney PW4152	2	232.197	0	0	52200	0.75	16.53936155	5.2	62.5095205	5898.617947	0.312	31.95571423	Rp	173,614.11
96	A318-100	57500	125766	2 Turbofan Engines	Pratt & Whitney PW6122	2	97.86	0	0	22000	0.75	14.91104859	5.2	62.5095205	2757.484	0.36	17.23690026	Rp	93,647.39
97	A319-100	61000	134482	2 Turbofan Engines	CFM Intl. CFM56-5B5	2	97.86	0	0	22000	0.75	14.05549662	5.2	62.5095205	2925.330852	0.32	16.25431368	Rp	88,309.03
98	A319-Neo	62800	138450	2 Turbofan Engines	IAE International Aero Engines V2524-A5	2	104.533	0	0	23500	0.75	14.58349335	5.2	62.5095205	3011.65209	0.36	18.82569281	Rp	102,279.23
99	A320-200	64500	142198	2 Turbofan Engines	CFM Intl. CFM56-5A1	2	111.206	0	0	25000	0.75	15.10544916	5.2	62.5095205	3093.177704	0.33	17.72403005	Rp	96,293.94
100	A320-Neo	66300	146166	2 Turbofan Engines	IAE International Aero Engines V2527-A5	2	117.878	0	0	26500	0.75	15.57706725	5.2	62.5095205	3179.498942	0.36	19.87489543	Rp	107,979.51
101	A321-100	75500	166449	2 Turbofan Engines	FM Intl. CFM56-5B1/P	2	133.447	0	0	30000	0.75	15.48558629	5.2	62.5095205	3620.696382	0.35	22.0041106	Rp	119,547.45
102	A321-200	77800	171520	2 Turbofan Engines	FM Intl. CFM56-5B3/2P	2	142.3	0	0	32000	0.75	16.02963859	5.2	62.5095205	3730.995742	0.36	23.32227549	Rp	126,708.99
103	A321-Neo	79200	174606	2 Turbofan Engines	IAE International Aero Engines V2533-A5	2	146.791	0	0	33000	0.75	16.23835784	5.2	62.5095205	3798.134483	0.37	24.40145533	Rp	132,572.13
104	A330-200	180000	396832	2 Turbofan Engines	General Electric CF6-80E1A2	2	300.255	0	0	67500	0.75	14.61452206	5.2	62.5095205	8632.123826	0.332	49.76218163	Rp	270,355.93
105	A330-200F	182000	401241	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	14.68946833	5.2	62.5095205	8728.036313	0.323	48.95113134	Rp	265,949.53
106	A330-300	187000	412264	2 Turbofan Engines	Pratt & Whitney PW4164	2	284.686	0	0	64000	0.75	13.33803083	5.2	62.5095205	8967.81753	0.323	50.29594264	Rp	273,255.84
107	A330-800	186000	410060	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	14.37356578	5.2	62.5095205	8919.861286	0.323	50.02698038	Rp	271,794.58
108	A330-900	191000	421083	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	13.99729443	5.2	62.5095205	9159.642504	0.323	51.37179169	Rp	279,100.88
109	A340-200	185000	407855	4 Turbofan Engines	CFM Intl. CFM56-5C2	4	138.785	0	0	31200	0.75	13.14517011	5.2	62.5095205	8871.905043	0.32	49.29586935	Rp	267,822.48
110	A340-300	192000	410060	4 Turbofan Engines	CFM Intl. CFM56-5C4	4	151.2	0	0	34000	0.75	13.80260417	5.2	62.5095205	9207.598747	0.33	52.75990341	Rp	286,642.44
111	A340-500	246000	542337	4 Turbofan Engines	Rolls-Royce Trent 553-61	4	235.756	0	0	53000	0.75	16.79283835	5.2	62.5095205	11797.23589	0.45	92.17994488	Rp	500,809.94
112	A340-600	265000	584225	4 Turbofan Engines	Rolls-Royce Trent 556-61	4	249.1	0	0	56000	0.75	16.47120977	5.2	62.5095205	12708.40452	0.45	99.29953412	Rp	539,490.38
113	A350-900	205000	451948	2 Turbofan Engines	Trent XWB-84	2	373	0	0	84000	0.75	15.96903874	5.2	62.5095205	9831.029912	0.45	76.81662073	Rp	417,341.62
114	A350-1000	233000	513677	2 Turbofan Engines	Trent XWB-97	2	431.5	0	0	97000	0.75	16.22441934	5.2	62.5095205	11173.80473	0.45	87.30864698	Rp	474,344.37
115	A380-800	395000	870826	4 Turbofan engines	Engine Alliance GP7270	4	311.376	0	0	70000	0.75	13.81288161	5.2	62.5095205	18942.71617	0.38	124.9883444	Rp	679,056.66

116	BAE146-100A	35153	77499.1	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803	0	0	6700	0.75	14.85579007	5.2	62.5095205	1685.805827	0.411	12.03075934	Rp	65,362.63
117	BAE146-200	36741	81000.04	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041	0	0	6970	0.75	14.78649193	5.2	62.5095205	1761.960342	0.408	12.48245356	Rp	67,816.67
118	BAE146-300	38329	84500.98	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617	0	0	7500	0.75	15.25166016	5.2	62.5095205	1838.114856	0.415	13.24537958	Rp	71,961.62
119	Avro RJ70	37875	83500.08	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803	0	0	6700	0.75	13.78813434	5.2	62.5095205	1816.342722	0.411	12.96233635	Rp	70,423.85
120	Avro RJ85	38556	85001.43	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041	0	0	6970	0.75	14.09042691	5.2	62.5095205	1849.000923	0.408	13.09908493	Rp	71,166.80
121	Avro RJ100	40143	88500.17	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617	0	0	7500	0.75	14.56246126	5.2	62.5095205	1925.107482	0.415	13.87224484	Rp	75,367.35
122	Bombardier Challenger 300	15308.74	33750	2 Turbofan engines	Honeywell HTF 7000 (AS907)	2	28.9134	0	0	6500	0.75	16.54730172	5.2	62.5095205	734.1497864	0.42	5.353990965	Rp	29,088.02
123	Bombardier CL-600	16329.33	36000	2 Turbofan enginess	Avco Lycoming ALF502L	2	33.3617	0	0	7500	0.75	17.89972541	5.2	62.5095205	783.0931055	0.428	5.819703195	Rp	31,618.21
124	Bombardier CL-601-3A	16329.33	36000	2 Turbofan enginess	General Electric CF34-3A	2	41.0126	0	0	9220	0.75	22.00472911	5.2	62.5095205	783.0931055	0.357	4.854285141	Rp	26,373.14
125	Bombardier CL-601-3R	16329.33	36000	2 Turbofan enginess	General Electric CF34-3A	2	41.0126	0	0	9220	0.75	22.00472911	5.2	62.5095205	783.0931055	0.357	4.854285141	Rp	26,373.14
126	Bombardier CL-604	17236.51	38000	2 Turbofan enginess	General Electric CF34-3B	2	41.0126	0	0	9220	0.75	20.84658547	5.2	62.5095205	826.598278	0.346	4.966086293	Rp	26,980.55
127	Bombardier CL-605	17236.51	38000	2 Turbofan enginess	General Electric CF34-3B1	2	41.0126	0	0	9220	0.75	20.84658547	5.2	62.5095205	826.598278	0.346	4.966086293	Rp	26,980.55
128	LEARJET-24D	5388.677	11880	2 Turbojet engines	General Electric CJ610-6	2	13.1	0	0	2950	0.75	21.33502625	5.2	62.5095205	258.4207248	0.98	4.397411246	Rp	23,890.96
129	LEARJET-25D	6032.779	13300	2 Turbojet engines	General Electric CJ610-8A	2	13.1	0	0	2950	0.75	19.05715127	5.2	62.5095205	289.3093973	0.98	4.923027741	Rp	26,746.61
130	LEARJET-31A	7257.478	16000	2 Turbofan engines	Garrett TFE731-2	2	15.6	0	0	3500	0.75	18.79471169	5.2	62.5095205	348.0413802	0.504	3.045825971	Rp	16,547.85
131	LEARJET-35A/-36A	6939.963	15300	2 Turbofan engines	Garrett TFE731-2-2B	2	15.6	0	0	3500	0.75	19.65460046	5.2	62.5095205	332.8145698	0.504	2.912571085	Rp	15,823.88
132	LEARJET-40	8708.974	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20AR	2	15.6	0	0	3500	0.75	15.66225974	5.2	62.5095205	417.6496563	0.441	3.19811727	Rp	17,375.24
133	LEARJET-45X	8708.974	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20BR	2	15.6	0	0	3500	0.75	15.66225974	5.2	62.5095205	417.6496563	0.441	3.19811727	Rp	17,375.24
134	LEARJET-55	8164.663	18000	2 Turbofan engines	Garrett TFE731-3A-2B	2	16.236	0	0	3650	0.75	17.4223994	5.2	62.5095205	391.5465528	0.515	3.501340123	Rp	19,022.64
135	Bombardier CRJ-100/-200	20276	44700	2 Turbofan engines	General Electric CF34-3A1	2	41.0126	0	0	9220	0.75	17.72156157	5.2	62.5095205	972.3607927	0.357	6.027529185	Rp	32,747.32
136	Bombardier CRJ-200LR	21319	47000	2 Turbofan engines	General Electric CF34-3B1	2	41.0126	0	0	9220	0.75	16.85456083	5.2	62.5095205	1022.379155	0.346	6.142310287	Rp	33,370.93
137	Bombardier CRJ700	30390	67000	2 Turbofan engines	General Electric CF34-8C1	2	60.9	0	0	13700	0.75	17.56884521	5.2	62.5095205	1457.390239	0.37	9.363134185	Rp	50,869.53
138	Bombardier CRJ1000	36968	81500	2 Turbofan engines	General Electric CF34-8C5A1	2	64.4992	0	0	14500	0.75	15.28605423	5.2	62.5095205	1772.846409	0.39	12.00547605	Rp	65,225.27
139	Dornier 328 Jet/-300	14390	31724	2 Turbofan engines	Pratt & Whitney Canada PW306B	2	26.9	0	0	6050	0.75	16.385056	5.2	62.5095205	690.0903436	0.394	4.721128693	Rp	25,649.70
140	EMB135BJ	18500	40785	2 Turbofan engines	Allison / Rolls-Royce AE3007A1/3	2	32.0272	0	0	7200	0.75	15.16750397	5.2	62.5095205	887.1905043	0.36	5.545785302	Rp	30,130.03
141	ERJ190-100LR	43000	94799	2 Turbofan engines	General Electric CF34-10E5	2	82.3	0	0	18500	0.75	16.76704856	5.2	62.5095205	2062.118469	0.38	13.6063261	Rp	73,922.62
142	F-28 Fellowship	29030	64000	2 Turbofan engines	Rolls-Royce RB.183 Spey Mk.555-15P	2	44.0374	0	0	9900	0.75	13.29050576	5.2	62.5095205	1392.169748	0.75	18.12997154	Rp	98,499.41
143	F-70	36740	81000	2 Turbofan engines	Rolls-Royce Tay 620-15	2	616	0	0	13850	0.75	14.69142664	5.2	62.5095205	1761.912385	0.43	13.15516897	Rp	71,471.50
144	F-100	38780	88000	2 Turbofan engines	Rolls-Royce Tay 650-15	2	672	0	0	15100	0.75	15.17478309	5.2	62.5095205	1859.743122	0.43	13.88561385	Rp	75,439.98
145	Cessna Citation Sovereign	12508	27575	2 Turbofan engines	Pratt & Whitney Canada PW306C	2	25.2926	0	0	5686	0.75	17.7162717	5.2	62.5095205	599.8366934	0.394	4.103674614	Rp	22,295.10
146	Cessna Citation Longitude	15195	33500	2 Turbofan engines	Honeywell HTF7700L	2	33.81	0	0	7600	0.75	19.4924414	5.2	62.5095205	728.6951196	0.41	5.187682454	Rp	28,184.47
147	Cessna Citation CJ1+	4490.564	9900	2 Turbofan engines	Williams / Rolls-Royce FJ44-1AP	2	8.5	0	0	1900	0.75	16.48944402	5.2	62.5095205	215.350604	0.456	1.705118646	Rp	9,263.84
148	Cessna Citation CJ1	4445.205	9800	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5	0	0	1900	0.75	16.65770365	5.2	62.5095205	213.1753454	0.456	1.687895226	Rp	9,170.27
149	Cessna Citation CJ2+	5227.652	11525	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447	0	0	3000	0.75	22.36494976	5.2	62.5095205	250.6985567	0.46	2.002411506	Rp	10,879.02
150	Cessna Citation CJ2	5216.312	11500	2 Turbofan engines	Williams / Rolls-Royce FJ44-2C	2	10.6757	0	0	2400	0.75	17.93085537	5.2	62.5095205	250.154742	0.46	1.99806788	Rp	10,855.42
151	Cessna Citation CJ3	5783.303	12750	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447	0	0	3000	0.75	20.21616047	5.2	62.5095205	277.3454749	0.46	2.215249172	Rp	12,035.36
152	Cessna Citation Encore	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	20.46786497	5.2	62.5095205	330.6393112	0.394	2.262009248	Rp	12,289.41
153	Cessna Citation Encore+	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	20.46786497	5.2	62.5095205	330.6393112	0.394	2.262009248	Rp	12,289.41
154	Cessna Citation II/-IISP	6123.497	13500	2 Turbofan engines	Pratt & Whitney Canada JT15D-4	2	11.1	0	0	2500	0.75	15.91086704	5.2	62.5095205	293.6599146	0.562	2.865659926	Rp	15,569.02
155	Cessna Citation I/-ISP	5148.273	11350	2 Turbofan engines	Pratt & Whitney Canada JT15D-1A	2	9.8	0	0	2200	0.75	16.65384144	5.2	62.5095205	246.8918541	0.54	2.314963712	Rp	12,577.10
156	Cessna Citation Jet	4399.846	9700	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5	0	0	1900	0.75	16.82943255	5.2	62.5095205	211.0000868	0.456	1.670671805	Rp	9,076.69
157	Cessna Citation Mustang	3628.739	8000	2 Turbofan engines	Pratt & Whitney Canada PW615F	2	6.0051	0	0	1350	0.75	14.49877759	5.2	62.5095205	174.0206901	0.394	1.190531183	Rp	6,468.11
158	Cessna Citation S/II	6350.293	14000	2 Turbofan engines	Pratt & Whitney Canada JT15D-4B	2	11.1	0	0	2500	0.75	15.34262178	5.2	62.5095205	304.5362077	0.562	2.971795479	Rp	16,145.65
159	Cessna Citation Ultra	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	20.46786497	5.2	62.5095205	330.6393112	0.394	2.262009248	Rp	12,289.41
160	Cessna Citation V	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada JT15D-5A	2	12.8998	0	0	2900	0.75	16.39238012	5.2	62.5095205	330.6393112	0.551	3.163368263	Rp	17,186.45
161	Cessna Citation Excel	8482.177	18700	2 Turbofan engines	Pratt & Whitney Canada PW545A	2	16.8321	0	0	3784	0.75	17.385898	5.2	62.5095205	406.7733631	0.394	2.782866641	Rp	15,119.20
162	Cessna Citation III	9071.847	20000	2 Turbofan engines	Garrett TFE731-3-100S	2	16.2	0	0	3650	0.75	15.68015946	5.2	62.5095205	435.0517253	0.511	3.860161387	Rp	20,972.10
163	Cessna Citation VI	9071.847	20000	2 Turbofan engines	Garrett TFE731-3B-100	2	16.2	0	0	3650	0.75	15.68015946	5.2	62.5095205	435.0517253	0.507	3.829944859	Rp	20,807.94
164	Cessna Citation VII	9071.847	20000	2 Turbofan engines	Garrett TFE731-4	2	18.1487	0	0	4080	0.75	17.52741113	5.2	62.5095205	435.0517253	0.517	3.905486178	Rp	21,218.35
165	Cessna Citation XLS	8482.177	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C	2	28.6554	0	0	6442	0.75	29.59829676	5.2	62.5095205	406.7733631	0.36	2.542720788	Rp	13,814.50
166	Cessna Citation XLS+	8482.177	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C1	2	30.0878	0	0	6764	0.75	31.07775214	5.2	62.5095205	406.7733631	0.36	2.542720788	Rp	13,814.50

d. Gradien 1,5° (g = 2,6 %)

No	Aircraft	MLW		Propulsion	engines	n	Power engines				Engine	V taxiing Calculated	V application	Time (s)	Resultant Force	SFC	Fuel Consumpstion	Biaya	
		Kg	Lbs			Engine	kN	kW	hp	lbf	efficiency				(lbf)	(lb/lbf/h)	(lb)		
1	DC-9-15	37059	81700	2 Turbofan Engines	Pratt & Whitney JT8D-7	2	62.3	0	0	14000	0.75	9.815761375	5.2	62.52142453	2492.356656	0.585	25.3216744	Rp	137,571.64
2	DC-9-21	43227	95300	2 Turbofan Engines	Pratt & Whitney JT8D-11	2	66.7	0	0	15000	0.75	9.016247305	5.2	62.52142453	2907.177776	0.62	31.3032654	Rp	170,069.38
3	DC-9-32	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-15	2	68.95	0	0	15500	0.75	8.968441478	5.2	62.52142453	3020.096819	0.62	32.51913009	Rp	176,675.13
4	DC-9-33F	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3	0	0	14500	0.75	8.38983235	5.2	62.52142453	3020.096819	0.565	29.63436855	Rp	161,002.33
5	DC-9-41	46266	102000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	8.98561241	5.2	62.52142453	3111.561916	0.6	32.42321392	Rp	176,154.02
6	DC-9-51	49895	110000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	8.33206421	5.2	62.52142453	3355.625769	0.6	34.96641721	Rp	189,971.14
7	DC-9-80	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	7.160322834	5.2	62.52142453	3904.752623	0.6	40.68844941	Rp	221,058.71
8	DC-8-61	108862	240000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	8.592426866	5.2	62.52142453	7321.377542	0.51	64.8469184	Rp	352,310.70
9	DC-8-63	117027	258000	4 Turbofan Engines	Pratt & Whitney JT3D-7	4	84.5	0	0	19000	0.75	8.436983059	5.2	62.52142453	7870.504396	0.52	71.07752118	Rp	386,161.32
10	DC-10-10	164881	363500	3 Turbofan Engines	General Electric CF6-6D	3	185	0	0	41500	0.75	9.809760296	5.2	62.52142453	11088.86526	0.35	67.40335513	Rp	366,199.72
11	DC-10-30	182798	403000	3 Turbofan Engines	General Electric CF6-50C	3	226	0	0	50800	0.75	10.83111542	5.2	62.52142453	12293.85067	0.394	84.12218013	Rp	457,032.43
12	DC-10-40	182798	403000	3 Turbofan Engines	Pratt and Whitney JT9D-20	3	219.7	0	0	49400	0.75	10.53262012	5.2	62.52142453	12293.85067	0.37	78.99798641	Rp	429,192.89
13	MD-11 -Passengger	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	12.12708852	5.2	62.52142453	13117.70909	0.322	73.35677515	Rp	398,544.41
14	MD-11 -Passengger-ER	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	12.12708852	5.2	62.52142453	13117.70909	0.322	73.35677515	Rp	398,544.41
15	MD-11-Combi	207749	458000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	11.3856835	5.2	62.52142453	13971.89894	0.322	78.13357061	Rp	424,496.55
16	MD-11-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	11.05971965	5.2	62.52142453	14383.69365	0.322	80.4364065	Rp	437,007.77
17	MD-11-Convertible-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	11.05971965	5.2	62.52142453	14383.69365	0.322	80.4364065	Rp	437,007.77
18	MD-81	58061	128000	2 Turbofan Engines	Pratt & Whitney JT8D-209	2	82.3	0	0	18500	0.75	8.278980684	5.2	62.52142453	3904.819877	0.51	34.58577768	Rp	187,903.14
19	MD-82	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217A	2	89	0	0	20000	0.75	8.812733049	5.2	62.52142453	3965.751773	0.53	36.50293294	Rp	198,318.97
20	MD-83	63276	139500	2 Turbofan Engines	Pratt & Whitney JT8D-219	2	93.4	0	0	21000	0.75	8.623229205	5.2	62.52142453	4255.548174	0.519	38.35740632	Rp	208,394.25
21	MD-87	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89	0	0	20000	0.75	8.950403543	5.2	62.52142453	3904.752623	0.5	33.90704117	Rp	184,215.59
22	MD-88	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89	0	0	20000	0.75	8.812733049	5.2	62.52142453	3965.751773	0.5	34.43672919	Rp	187,093.37
23	MD-90-30	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2525-D5	2	111.2	0	0	25000	0.75	10.08501067	5.2	62.52142453	4331.813925	0.35	26.33080891	Rp	143,054.23
24	MD-90-30ER	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2528-D5	2	124.5	0	0	28000	0.75	11.29521195	5.2	62.52142453	4331.813925	0.35	26.33080891	Rp	143,054.23
25	B707-120B	86300	190000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	10.83880386	5.2	62.52142453	5803.998474	0.51	51.40718578	Rp	279,293.18
26	B707-320	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	9.950944398	5.2	62.52142453	6321.852335	0.51	55.99392194	Rp	304,212.73
27	B707-420	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	9.950944398	5.2	62.52142453	6321.852335	0.51	55.99392194	Rp	304,212.73
28	B707-320B	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	9.950944398	5.2	62.52142453	6321.852335	0.51	55.99392194	Rp	304,212.73
29	B707-320C	112100	247000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	8.344235267	5.2	62.52142453	7539.145179	0.51	66.77573031	Rp	362,789.86
30	B717-200	49898	110000	2 Turbofan Engines	Rolls-Royce BR700-715C1-30	2	95.3	0	0	21430	0.75	11.15908755	5.2	62.52142453	3355.82753	0.37	21.56392043	Rp	117,155.91
31	B720	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3C-7	4	53.4	0	0	12000	0.75	7.843931014	5.2	62.52142453	5346.672986	0.785	72.89196252	Rp	396,019.11
32	B720B	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3D-1	4	75.62	0	0	17000	0.75	11.1122356	5.2	62.52142453	5346.672986	0.52	48.28512167	Rp	262,331.13
33	B727-100	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3	0	0	14500	0.75	8.734632416	5.2	62.52142453	4351.317512	0.565	42.69682548	Rp	231,970.14
34	B727-100C	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3	0	0	14500	0.75	8.734632416	5.2	62.52142453	4351.317512	0.565	42.69682548	Rp	231,970.14
35	B727-200	73100	161000	3 Turbofan Engines	Pratt & Whitney JT8D-17	3	71.2	0	0	16000	0.75	8.530677368	5.2	62.52142453	4916.248997	0.6	51.22848177	Rp	278,322.28
36	B737-100	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3	0	0	14500	0.75	8.38983235	5.2	62.52142453	3020.096819	0.565	29.63436855	Rp	161,002.33
37	B737-200	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	8.898295029	5.2	62.52142453	3142.095118	0.6	32.74137713	Rp	177,882.59
38	B737-200-Convertible-Ex	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	8.898295029	5.2	62.52142453	3142.095118	0.6	32.74137713	Rp	177,882.59
39	B737-200 Advanced	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	8.565713598	5.2	62.52142453	3264.093417	0.6	34.01262838	Rp	184,789.24
40	B737-200C/-200QC	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	8.565713598	5.2	62.52142453	3264.093417	0.6	34.01262838	Rp	184,789.24
41	B737-300	52889	116000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9	0	0	22000	0.75	10.80804085	5.2	62.52142453	3556.983491	0.39	24.09199811	Rp	130,890.86
42	B737-400	56245	124000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9	0	0	22000	0.75	10.16315179	5.2	62.52142453	3782.68707	0.39	25.62072329	Rp	139,196.36
43	B737-500	49895	110000	2 Turbofan Engines	CFM Intl. CFM56-3C1	2	104.5	0	0	23500	0.75	12.23771931	5.2	62.52142453	3355.625769	0.33	19.23152947	Rp	104,484.13
44	B737-600	51936	121500	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	11.00636307	5.2	62.52142453	3492.890669	0.36	21.83805004	Rp	118,645.25
45	B737-700/-Winglets/-700C	58604	129200	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	9.754052158	5.2	62.52142453	3941.338662	0.36	24.64181077	Rp	133,877.97
46	B737-800/-800 Winglets	66361	146300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	10.68905662	5.2	62.52142453	4463.025988	0.38	29.45366726	Rp	160,020.59
47	B737-900/-900 Winglets	66814	147300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	10.61658465	5.2	62.52142453	4493.491935	0.38	29.65472679	Rp	161,112.94
48	B737-900ER/-900ER Winglets	71350	157300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	9.941646623	5.2	62.52142453	4798.554938	0.38	31.6679851	Rp	172,050.89
49	B737-BBJ	60781	134000	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	9.404690161	5.2	62.52142453	4087.750072	0.36	25.55719576	Rp	138,851.22
50	B737-BBJ2	66360	146300	2 Turbofan Engines	CFM Intl. CFM56-7B26	2	117.4	0	0	26400	0.75	10.33682591	5.2	62.52142453	4462.958734	0.38	29.45322342	Rp	160,018.18
51	B737 Max-7	66043	145600	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	11.01592298	5.2	62.52142453	4441.639296	0.342	26.38127352	Rp	143,328.40
52	B737 Max-8/-200-/-BBJ8	69308	152800	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	10.49697873	5.2	62.52142453	4661.222784	0.342	27.68549741	Rp	150,414.20
53	B737 Max-9	74343	163900	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	9.786053853	5.2	62.52142453	4999.845406	0.342	29.69675844	Rp	161,341.30
54	B747-100/-100B	265300	585000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	9.40207336	5.2	62.52142453	17842.41941	0.367	113.7224407	Rp	617,849.45
55	B747-100SF	255800	584000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	9.751251222	5.2	62.52142453	17203.5088	0.367	109.6502086	Rp	595,725.18

56	B747-100B SR	273500	564000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	9.120183044	5.2	62.52142453	18393.90015	0.367	117.2374201	Rp	636,946.20
57	B747-200B/-200B Combi	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	9.092475429	5.2	62.52142453	19218.70011	0.343	114.4839207	Rp	621,986.54
58	B747-200C	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	9.092475429	5.2	62.52142453	19218.70011	0.343	114.4839207	Rp	621,986.54
59	B747-200F	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	9.092475429	5.2	62.52142453	19218.70011	0.343	114.4839207	Rp	621,986.54
60	B747-300	255800	564000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	10.76700656	5.2	62.52142453	17203.5088	0.373	111.4428551	Rp	605,464.56
61	B747-300SR	242630	535000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	11.35144161	5.2	62.52142453	16317.77694	0.373	105.70516	Rp	574,291.89
62	B747-300	260320	574000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	10.58005638	5.2	62.52142453	17507.49574	0.373	113.4120564	Rp	616,163.15
63	B747-300 Combi	274380	605000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	10.03790465	5.2	62.52142453	18453.08344	0.373	119.5374925	Rp	649,442.40
64	B747-SP	204100	450000	4 Turbofan Engines	Pratt & Whitney JT9D-7FW	4	218.4	0	0	49100	0.75	12.50138515	5.2	62.52142453	13726.49002	0.367	87.48869263	Rp	475,322.55
65	B747-400 (CF6-80C2B1 engines)	285764	630000	4 Turbofan Engines	General Electric CF6-80C2B1F	4	254.3	0	0	57160	0.75	10.39451791	5.2	62.52142453	19218.70011	0.314	104.8045222	Rp	569,398.76
66	B747-8	312072	688000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8	0	0	66498	0.75	11.07320723	5.2	62.52142453	20988.01172	0.324	118.0980352	Rp	641,621.88
67	B747-8F	345184	761000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8	0	0	66498	0.75	10.01100261	5.2	62.52142453	23214.91784	0.324	130.628676	Rp	709,700.35
68	B757-200/-200PF	92250	210000	2 Turbofan Engines	Rolls-Royce RB.211-535E4-37	2	189	0	0	42500	0.75	11.9704977	5.2	62.52142453	6204.158276	0.324	34.91035321	Rp	189,666.55
69	B757-300	101610	224000	2 Turbofan Engines	Pratt & Whitney PW2043	2	189.49	0	0	42600	0.75	10.89338368	5.2	62.52142453	6833.65336	0.35	41.53816944	Rp	225,675.21
70	B767-200	123377	272000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5	0	0	48000	0.75	10.10873203	5.2	62.52142453	8297.565698	0.343	49.42778896	Rp	268,539.19
71	B767-200ER	136078	300000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5	0	0	48000	0.75	9.165221647	5.2	62.52142453	9151.755554	0.343	54.51611456	Rp	296,183.86
72	B767-300	136078	300000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	11.45652706	5.2	62.52142453	9151.755554	0.33	52.44990614	Rp	284,958.23
73	B767-300ER	145150	320000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	10.74048425	5.2	62.52142453	9761.881558	0.33	55.94661794	Rp	303,955.73
74	B767-300ER Freighter	147871	326000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	10.54284673	5.2	62.52142453	9944.879007	0.33	56.99540021	Rp	309,653.72
75	B767-400ER	158757	350000	2 Turbofan Engines	General Electric CF6-80C2B8F	2	282.46	0	0	63500	0.75	10.39275033	5.2	62.52142453	10677.00331	0.323	59.89330292	Rp	325,397.91
76	B777-200 (GE engines)	208700	460000	2 Turbofan Engines	General Electric GE90-94B	2	416.798	0	0	93700	0.75	11.6655923	5.2	62.52142453	14035.85726	0.324	78.97876113	Rp	429,088.44
77	B777-200 (P & W engines/RR engines)	206350	455000	2 Turbofan Engines	Pratt & Whitney PW4077	2	343.4	0	0	77200	0.75	9.720810558	5.2	62.52142453	13877.81095	0.33	79.53554675	Rp	432,113.43
78	B777-300	237680	524000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	12.10821045	5.2	62.52142453	15984.87088	0.324	89.94572087	Rp	488,671.49
79	B777-200LR	223168	492000	2 Turbofan Engines	General Electric GE90-115B	2	513.9	0	0	115540	0.75	13.45210022	5.2	62.52142453	15008.88449	0.324	84.4539155	Rp	458,834.73
80	B777-300ER	251290	554000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	11.45242333	5.2	62.52142453	16900.1944	0.324	95.09618057	Rp	516,653.73
81	B777-F	260816	575000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	11.03413694	5.2	62.52142453	17540.8536	0.324	98.70112393	Rp	536,239.24
82	B777-9	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5	0	0	78129	0.75	7.624287291	5.2	62.52142453	17906.8485	0.45	139.9452096	Rp	760,316.70
83	B777-9X/-8X	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5	0	0	78129	0.75	7.624287291	5.2	62.52142453	17906.8485	0.45	139.9452096	Rp	760,316.70
84	B787-8	172365	380000	2 Turbofan Engines	General Electric GEnx-1B70	2	321.6	0	0	72300	0.75	10.89880459	5.2	62.52142453	11592.19232	0.45	90.59504714	Rp	492,199.25
85	B787-9	192778	425000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6	0	0	78129	0.75	10.5303898	5.2	62.52142453	12965.04308	0.45	101.3241203	Rp	550,489.88
86	B787-10	201848	445000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6	0	0	78129	0.75	10.05720882	5.2	62.52142453	13575.03458	0.45	106.0913125	Rp	576,389.84
87	A300B2-100	127500	281089	2 Turbofan Engines	General Electric CF6-50C	2	226.859	0	0	51000	0.75	10.39320859	5.2	62.52142453	8574.852902	0.394	58.67448203	Rp	318,776.10
88	A300B2-200	130000	286600	2 Turbofan Engines	General Electric CF6-50C2	2	233.53	0	0	52500	0.75	10.49314329	5.2	62.52142453	8742.987272	0.371	56.33264195	Rp	306,052.98
89	A300B4-100	133000	293214	2 Turbofan Engines	General Electric CF6-50C2	2	233.53	0	0	52500	0.75	10.25645585	5.2	62.52142453	8944.748517	0.371	57.63262599	Rp	313,115.74
90	A300B4-600	134000	295419	2 Turbofan Engines	Pratt & Whitney PW4158	2	258	0	0	58000	0.75	11.24638243	5.2	62.52142453	9012.002265	0.323	50.55337775	Rp	274,654.47
91	A300C4-600	136000	299828	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3	0	0	60100	0.75	11.48220288	5.2	62.52142453	9146.509762	0.34	54.00832187	Rp	293,425.04
92	A300F4-200	136000	299828	2 Turbofan Engines	General Electric CF6-50C1	2	233.53	0	0	52500	0.75	10.0302105	5.2	62.52142453	9146.509762	0.371	58.93261004	Rp	320,178.50
93	A300F4-600	140000	308646	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3	0	0	60100	0.75	11.15413994	5.2	62.52142453	9415.524755	0.34	55.59680192	Rp	302,055.19
94	A310-200	118500	261247	2 Turbofan Engines	General Electric CF6-80A2	2	222.411	0	0	50000	0.75	10.9633002	5.2	62.52142453	7969.569167	0.357	49.41165771	Rp	268,451.55
95	A310-300	123000	271168	2 Turbofan Engines	Pratt & Whitney PW4152	2	232.197	0	0	52200	0.75	11.02694083	5.2	62.52142453	8272.211035	0.312	44.82316955	Rp	243,522.48
96	A318-100	57500	125766	2 Turbofan Engines	Pratt & Whitney PW6122	2	97.86	0	0	22000	0.75	9.941329959	5.2	62.52142453	3867.090524	0.36	24.17760084	Rp	131,355.93
97	A319-100	61000	134482	2 Turbofan Engines	CFM Intl. CFM56-5B5	2	97.86	0	0	22000	0.75	9.370925781	5.2	62.52142453	4102.478643	0.32	22.79936079	Rp	123,868.01
98	A319-Neo	62800	138450	2 Turbofan Engines	IAE International Aero Engines V2524-A5	2	104.533	0	0	23500	0.75	9.722945938	5.2	62.52142453	4223.53539	0.36	26.40614491	Rp	143,463.53
99	A320-200	64500	142198	2 Turbofan Engines	CFM Intl. CFM56-5A1	2	111.206	0	0	25000	0.75	10.07093856	5.2	62.52142453	4337.866762	0.33	24.86088086	Rp	135,068.17
100	A320-Neo	66300	146166	2 Turbofan Engines	IAE International Aero Engines V2527-A5	2	117.878	0	0	26500	0.75	10.38537058	5.2	62.52142453	4458.923509	0.36	27.87782496	Rp	151,459.10
101	A321-100	75500	166449	2 Turbofan Engines	FM Intl. CFM56-5B1/P	2	133.447	0	0	30000	0.75	10.3243794	5.2	62.52142453	5077.657993	0.35	30.86440107	Rp	167,685.05
102	A321-200	77800	171520	2 Turbofan Engines	FM Intl. CFM56-5B3/2P	2	142.3	0	0	32000	0.75	10.68710395	5.2	62.52142453	5232.341614	0.36	32.71334513	Rp	177,730.29
103	A321-Neo	79200	174606	2 Turbofan Engines	IAE International Aero Engines V2533-A5	2	146.791	0	0	33000	0.75	10.82625895	5.2	62.52142453	5326.496861	0.37	34.22707318	Rp	185,954.31
104	A330-200	180000	396832	2 Turbofan Engines	General Electric CF6-80E1A2	2	300.255	0	0	67500	0.75	9.743633057	5.2	62.52142453	12105.67468	0.332	69.79968242	Rp	379,218.87
105	A330-200F	182000	401241	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	9.793600406	5.2	62.52142453	12240.18218	0.323	68.66205038	Rp	373,038.16
106	A330-300	187000	412264	2 Turbofan Engines	Pratt & Whitney PW4164	2	284.686	0	0	64000	0.75	8.892584893	5.2	62.52142453	12576.45092	0.323	70.54837044	Rp	383,286.46
107	A330-800	186000	410060	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	9.582985343	5.2	62.52142453	12509.19717	0.323	70.17110643	Rp	381,236.80
108	A330-900	191000	421083	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	9.332121853	5.2	62.52142453	12845.46592	0.323	72.05742649	Rp	391,485.10
109	A340-200	185000	407855	4 Turbofan Engines	CFM Intl. CFM56-5C2	4	138.785	0	0	31200	0.75	8.764002922	5.2	62.52142453	12441.94343	0.32	69.14560239	Rp	375,665.28
110	A340-300	192000	410060	4 Turbofan Engines	CFM Intl. CFM56-5C4	4	151.2	0	0	34000	0.75	9.202320109	5.2	62.52142453	12912.71966	0.33	74.00448256	Rp	402,063.38
111	A340-500	246000	542337	4 Turbofan Engines	Rolls-Royce Trent 553-61	4	235.756	0	0	53000	0.75	11.19593609	5.2	62.52142453	16544.42207	0.45	129.2976045	Rp	702,468.69
112	A340-600	265000	584225	4 Turbofan Engines	Rolls-Royce Trent 556-61	4	249.1	0	0	56000	0.75	10.98150342	5.2	62.52142453	17822.24329	0.45	139.2840048	Rp	756,724.41
113	A350-900	205000	451948	2 Turbofan Engines	Trent XWB-84	2	373	0	0	84000	0.75	10.64670149	5.2	62.52142453	13787.01839	0.45	107.7480037	Rp	585,390.58
114	A350-1000	233000	513677	2 Turbofan Engines	Trent XWB-97	2	431.5	0	0	97000	0.75	10.81696603	5.2	62.52142453	15670.12334	0.45	122.4648042	Rp	665,346.36
115	A380-800	395000	870826	4 Turbofan engines	Engine Alliance GP7270	4	311.376	0	0	70000	0.75	9.209172172	5.2	62.52142453	26565.23056	0.38	175.3168061	Rp	952,489.17

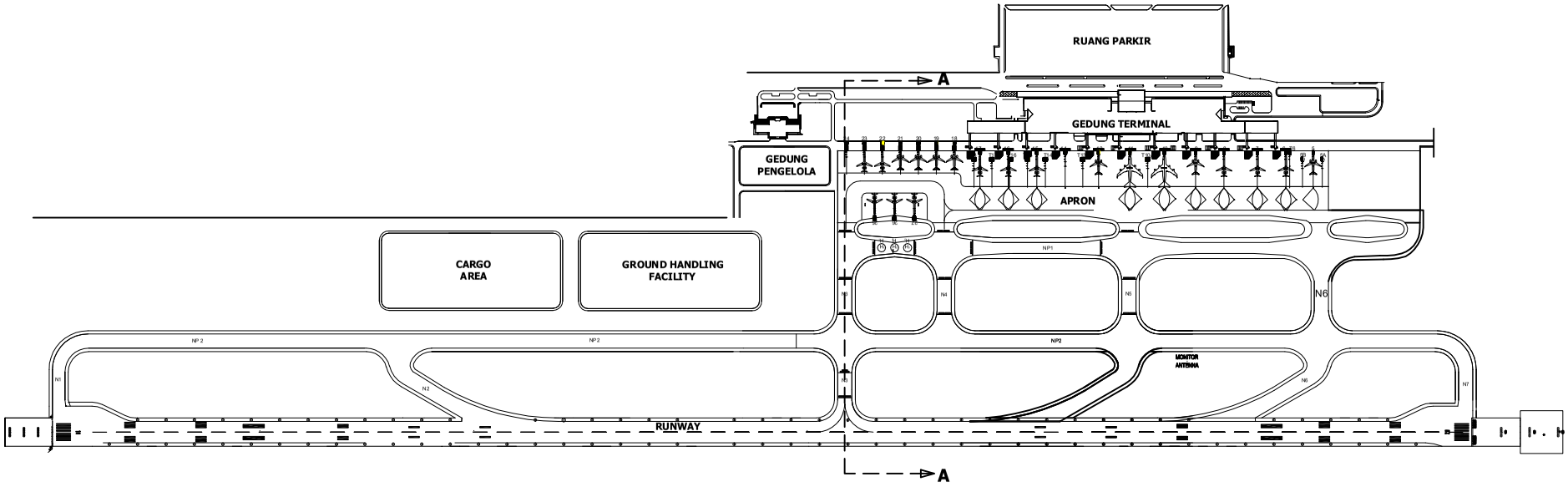
116	BAE146-100A	35153	77499.1	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803	0	0	6700	0.75	9.904488604	5.2	62.52142453	2364.171012	0.411	16.87512793	Rp	91,681.89
117	BAE146-200	36741	81000.04	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041	0	0	6970	0.75	9.858286914	5.2	62.52142453	2470.969964	0.408	17.50870371	Rp	95,124.08
118	BAE146-300	38329	84500.98	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617	0	0	7500	0.75	10.16841875	5.2	62.52142453	2577.768917	0.415	18.57883352	Rp	100,938.06
119	Avro RJ70	37875	83500.08	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803	0	0	6700	0.75	9.192672948	5.2	62.52142453	2547.235715	0.411	18.18181863	Rp	98,781.09
120	Avro RJ85	38556	85001.43	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041	0	0	6970	0.75	9.394214117	5.2	62.52142453	2593.035517	0.408	18.3736311	Rp	99,823.20
121	Avro RJ100	40143	88500.17	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617	0	0	7500	0.75	9.708923655	5.2	62.52142453	2699.767216	0.415	19.45811563	Rp	105,715.16
122	Bombardier Challenger 300	15308.74	33750	2 Turbofan engines	Honeywell HTF 7000 (AS907)	2	28.9134	0	0	6500	0.75	11.03223461	5.2	62.52142453	1029.570319	0.42	7.509857019	Rp	40,800.75
123	Bombardier CL-600	16329.33	36000	2 Turbofan enginess	Avco Lycoming ALF502L	2	33.3617	0	0	7500	0.75	11.93390763	5.2	62.52142453	1098.208341	0.428	8.163095376	Rp	44,349.77
124	Bombardier CL-601-3A	16329.33	36000	2 Turbofan enginess	General Electric CF34-3A	2	41.0126	0	0	9220	0.75	14.67075044	5.2	62.52142453	1098.208341	0.357	6.808937031	Rp	36,992.68
125	Bombardier CL-601-3R	16329.33	36000	2 Turbofan enginess	General Electric CF34-3A	2	41.0126	0	0	9220	0.75	14.67075044	5.2	62.52142453	1098.208341	0.357	6.808937031	Rp	36,992.68
126	Bombardier CL-604	17236.51	38000	2 Turbofan enginess	General Electric CF34-3B	2	41.0126	0	0	9220	0.75	13.89860568	5.2	62.52142453	1159.219915	0.346	6.96575662	Rp	37,844.68
127	Bombardier CL-605	17236.51	38000	2 Turbofan enginess	General Electric CF34-3B1	2	41.0126	0	0	9220	0.75	13.89860568	5.2	62.52142453	1159.219915	0.346	6.96575662	Rp	37,844.68
128	LEARJET-24D	5388.677	11880	2 Turbojet engines	General Electric CJ610-6	2	13.1	0	0	2950	0.75	14.22425353	5.2	62.52142453	362.4087524	0.98	6.168095899	Rp	33,511.02
129	LEARJET-25D	6032.779	13300	2 Turbojet engines	General Electric CJ610-8A	2	13.1	0	0	2950	0.75	12.70557383	5.2	62.52142453	405.7269703	0.98	6.905359886	Rp	37,516.54
130	LEARJET-31A	7257.478	16000	2 Turbofan engines	Garrett TFE731-2	2	15.6	0	0	3500	0.75	12.53060301	5.2	62.52142453	488.0925959	0.504	4.272274215	Rp	23,211.09
131	LEARJET-35A/-36A	6939.963	15300	2 Turbofan engines	Garrett TFE731-2-2B	2	15.6	0	0	3500	0.75	13.10389857	5.2	62.52142453	466.7385448	0.504	4.085362219	Rp	22,195.61
132	LEARJET-40	8708.974	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20AR	2	15.6	0	0	3500	0.75	10.44216917	5.2	62.52142453	585.711115	0.441	4.485887926	Rp	24,371.65
133	LEARJET-45X	8708.974	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20BR	2	15.6	0	0	3500	0.75	10.44216917	5.2	62.52142453	585.711115	0.441	4.485887926	Rp	24,371.65
134	LEARJET-55	8164.663	18000	2 Turbofan engines	Garrett TFE731-3A-2B	2	16.236	0	0	3650	0.75	11.61567009	5.2	62.52142453	549.1041703	0.515	4.911208083	Rp	26,682.40
135	Bombardier CRJ-100/-200	20276	44700	2 Turbofan engines	General Electric CF34-3A1	2	41.0126	0	0	9220	0.75	11.81512419	5.2	62.52142453	1363.636999	0.357	8.454605669	Rp	45,933.53
136	Bombardier CRJ-200LR	21319	47000	2 Turbofan engines	General Electric CF34-3B1	2	41.0126	0	0	9220	0.75	11.23708702	5.2	62.52142453	1433.782659	0.346	8.61560513	Rp	46,808.24
137	Bombardier CRJ700	30390	67000	2 Turbofan engines	General Electric CF34-8C1	2	60.9	0	0	13700	0.75	11.71330682	5.2	62.52142453	2043.841409	0.37	13.13334285	Rp	71,352.92
138	Bombardier CRJ1000	36968	81500	2 Turbofan engines	General Electric CF34-8C5A1	2	64.4992	0	0	14500	0.75	10.19134959	5.2	62.52142453	2486.236565	0.39	16.83966394	Rp	91,489.22
139	Dornier 328 Jet/-300	14390	31724	2 Turbofan engines	Pratt & Whitney Canada PW306B	2	26.9	0	0	6050	0.75	10.92406393	5.2	62.52142453	967.7814373	0.394	6.622163109	Rp	35,977.95
140	EMB135BJ	18500	40785	2 Turbofan engines	Allison / Rolls-Royce AE3007A1/3	2	32.0272	0	0	7200	0.75	10.11231106	5.2	62.52142453	1244.194343	0.36	7.778880269	Rp	42,262.34
141	ERJ190-100LR	43000	94799	2 Turbofan engines	General Electric CF34-10E5	2	82.3	0	0	18500	0.75	11.1787418	5.2	62.52142453	2891.911175	0.38	19.08512066	Rp	103,688.69
142	F-28 Fellowship	29030	64000	2 Turbofan engines	Rolls-Royce RB.183 Spey Mk.555-15P	2	44.0374	0	0	9900	0.75	8.860899507	5.2	62.52142453	1952.376312	0.75	25.43028088	Rp	138,161.69
143	F-70	36740	81000	2 Turbofan engines	Rolls-Royce Tay 620-15	2	616	0	0	13850	0.75	9.794906031	5.2	62.52142453	2470.902711	0.43	18.45229824	Rp	100,250.60
144	F-100	38780	88000	2 Turbofan engines	Rolls-Royce Tay 650-15	2	672	0	0	15100	0.75	10.11716412	5.2	62.52142453	2608.100357	0.43	19.47686787	Rp	105,817.04
145	Cessna Citation Sovereign	12508	27575	2 Turbofan engines	Pratt & Whitney Canada PW306C	2	25.2926	0	0	5686	0.75	11.81159739	5.2	62.52142453	841.2098831	0.394	5.756081735	Rp	31,272.56
146	Cessna Citation Longitude	15195	33500	2 Turbofan engines	Honeywell HTF7700L	2	33.81	0	0	7600	0.75	12.99578567	5.2	62.52142453	1021.920705	0.41	7.276581852	Rp	39,533.38
147	Cessna Citation CJ1+	4490.564	9900	2 Turbofan engines	Williams / Rolls-Royce FJ44-1AP	2	8.5	0	0	1900	0.75	10.99366036	5.2	62.52142453	302.0072937	0.456	2.391710655	Rp	12,994.07
148	Cessna Citation CJ1	4445.205	9800	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5	0	0	1900	0.75	11.10584057	5.2	62.52142453	298.956715	0.456	2.367551961	Rp	12,862.81
149	Cessna Citation CJ2+	5227.652	11525	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447	0	0	3000	0.75	14.91091278	5.2	62.52142453	351.579198	0.46	2.808713015	Rp	15,259.63
150	Cessna Citation CJ2	5216.312	11500	2 Turbofan engines	Williams / Rolls-Royce FJ44-2C	2	10.6757	0	0	2400	0.75	11.95466225	5.2	62.52142453	350.8165533	0.46	2.802620362	Rp	15,226.52
151	Cessna Citation CJ3	5783.303	12750	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447	0	0	3000	0.75	13.47829567	5.2	62.52142453	388.9487873	0.46	3.10725301	Rp	16,881.58
152	Cessna Citation Encore	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	13.64610932	5.2	62.52142453	463.6879661	0.394	3.172841744	Rp	17,237.92
153	Cessna Citation Encore+	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	13.64610932	5.2	62.52142453	463.6879661	0.394	3.172841744	Rp	17,237.92
154	Cessna Citation II/-IISP	6123.497	13500	2 Turbofan engines	Pratt & Whitney Canada JT15D-4	2	11.1	0	0	2500	0.75	10.60791789	5.2	62.52142453	411.8281278	0.562	4.019561567	Rp	21,838.12
155	Cessna Citation I/-ISP	5148.273	11350	2 Turbofan engines	Pratt & Whitney Canada JT15D-1A	2	9.8	0	0	2200	0.75	11.1032656	5.2	62.52142453	346.2406852	0.54	3.24711913	Rp	17,641.47
156	Cessna Citation Jet	4399.846	9700	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5	0	0	1900	0.75	11.22033377	5.2	62.52142453	295.9061362	0.456	2.343393268	Rp	12,731.56
157	Cessna Citation Mustang	3628.739	8000	2 Turbofan engines	Pratt & Whitney Canada PW615F	2	6.0051	0	0	1350	0.75	9.666465177	5.2	62.52142453	244.0462979	0.394	1.669916707	Rp	9,072.59
158	Cessna Citation S/II	6350.293	14000	2 Turbofan engines	Pratt & Whitney Canada JT15D-4B	2	11.1	0	0	2500	0.75	10.22906368	5.2	62.52142453	427.0810214	0.562	4.168434217	Rp	22,646.94
159	Cessna Citation Ultra	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	13.64610932	5.2	62.52142453	463.6879661	0.394	3.172841744	Rp	17,237.92
160	Cessna Citation V	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada JT15D-5A	2	12.8998	0	0	2900	0.75	10.92894698	5.2	62.52142453	463.6879661	0.551	4.437146703	Rp	24,106.84
161	Cessna Citation Excel	8482.177	18700	2 Turbofan engines	Pratt & Whitney Canada PW545A	2	16.8321	0	0	3784	0.75	11.59133428	5.2	62.52142453	570.4582214	0.394	3.903430303	Rp	21,207.18
162	Cessna Citation III	9071.847	20000	2 Turbofan engines	Garrett TFE731-3-100S	2	16.2	0	0	3650	0.75	10.45410308	5.2	62.52142453	610.1157448	0.511	5.414514197	Rp	29,416.84
163	Cessna Citation VI	9071.847	20000	2 Turbofan engines	Garrett TFE731-3B-100	2	16.2	0	0	3650	0.75	10.45410308	5.2	62.52142453	610.1157448	0.507	5.372130524	Rp	29,186.57
164	Cessna Citation VII	9071.847	20000	2 Turbofan engines	Garrett TFE731-4	2	18.1487	0	0	4080	0.75	11.68568235	5.2	62.52142453	610.1157448	0.517	5.478089706	Rp	29,762.24
165	Cessna Citation XLS	8482.177	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C	2	28.6554	0	0	6442	0.75	19.73345016	5.2	62.52142453	570.4582214	0.36	3.566586064	Rp	19,377.12
166	Cessna Citation XLS+	8482.177	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C1	2	30.0878	0	0	6764	0.75	20.71981635	5.2	62.52142453	570.4582214	0.36	3.566586064	Rp	19,377.12

e. Gradien 2° (g = 3,5 %)

No	Aircraft	MLW		Propulsion	engines	n	Power engines				Engine	V taxiing Calculated	V application	Time (s)	Resultant Force	SFC	Fuel Consumpstion	Biaya	
		Kg	Lbs			Engine	kN	kW	hp	lbf	efficiency				(lbf)	(lb/lbf/h)	(lb)		
1	DC-9-15	37059	81700	2 Turbofan Engines	Pratt & Whitney JT8D-7	2	62.3	0	0	14000	0.75	7.362475175	5.2	62.53809652	3207.31158	0.585	32.59411369	Rp	177,082.51
2	DC-9-21	43227	95300	2 Turbofan Engines	Pratt & Whitney JT8D-11	2	66.7	0	0	15000	0.75	6.762786342	5.2	62.53809652	3741.127868	0.62	40.29363048	Rp	218,913.68
3	DC-9-32	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-15	2	68.95	0	0	15500	0.75	6.726928786	5.2	62.53809652	3886.438755	0.62	41.85869411	Rp	227,416.60
4	DC-9-33F	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3	0	0	14500	0.75	6.29293338	5.2	62.53809652	3886.438755	0.565	38.14542286	Rp	207,242.55
5	DC-9-41	46266	102000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	6.739808129	5.2	62.53809652	4004.141438	0.6	41.73523062	Rp	226,745.83
6	DC-9-51	49895	110000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	6.249603425	5.2	62.53809652	4318.217202	0.6	45.00884736	Rp	244,531.26
7	DC-9-80	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-17A	2	71.2	0	0	16000	0.75	5.370719306	5.2	62.53809652	5024.866033	0.6	52.3742595	Rp	284,547.25
8	DC-8-61	108862	240000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	6.444892768	5.2	62.53809652	9421.580539	0.51	83.47109269	Rp	453,495.10
9	DC-8-63	117027	258000	4 Turbofan Engines	Pratt & Whitney JT3D-7	4	84.5	0	0	19000	0.75	6.328299554	5.2	62.53809652	10128.22937	0.52	91.49113797	Rp	497,067.68
10	DC-10-10	164881	363500	3 Turbofan Engines	General Electric CF6-6D	3	185	0	0	41500	0.75	7.357973967	5.2	62.53809652	14269.806	0.35	86.76174354	Rp	471,373.07
11	DC-10-30	182798	403000	3 Turbofan Engines	General Electric CF6-50C	3	226	0	0	50800	0.75	8.124058377	5.2	62.53809652	15820.45231	0.394	108.282251	Rp	588,293.12
12	DC-10-40	182798	403000	3 Turbofan Engines	Pratt and Whitney JT9D-20	3	219.7	0	0	49400	0.75	7.900167005	5.2	62.53809652	15820.45231	0.37	101.6863778	Rp	552,458.01
13	MD-11 -Passengger	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	9.096124563	5.2	62.53809652	16880.64192	0.322	94.42499857	Rp	513,007.23
14	MD-11 -Passengger-ER	195048	430000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	9.096124563	5.2	62.53809652	16880.64192	0.322	94.42499857	Rp	513,007.23
15	MD-11-Combi	207749	458000	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	8.54002139	5.2	62.53809652	17979.86382	0.322	100.5737	Rp	546,412.87
16	MD-11-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	8.295526782	5.2	62.53809652	18509.78554	0.322	103.5379153	Rp	562,517.34
17	MD-11-Convertible-Freighter	213872	471500	3 Turbofan Engines	General Electric CF6-80C2D1F	3	270	0	0	60690	0.75	8.295526782	5.2	62.53809652	18509.78554	0.322	103.5379153	Rp	562,517.34
18	MD-81	58061	128000	2 Turbofan Engines	Pratt & Whitney JT8D-209	2	82.3	0	0	18500	0.75	6.209787243	5.2	62.53809652	5024.952579	0.51	44.51888733	Rp	241,869.33
19	MD-82	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217A	2	89	0	0	20000	0.75	6.610137087	5.2	62.53809652	5103.363338	0.53	46.98665371	Rp	255,276.60
20	MD-83	63276	139500	2 Turbofan Engines	Pratt & Whitney JT8D-219	2	93.4	0	0	21000	0.75	6.467996575	5.2	62.53809652	5476.290443	0.519	49.37373582	Rp	268,245.52
21	MD-87	58060	128000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89	0	0	20000	0.75	6.713399132	5.2	62.53809652	5024.866033	0.5	43.64521625	Rp	237,122.71
22	MD-88	58967	130000	2 Turbofan Engines	Pratt & Whitney JT8D-217C	2	89	0	0	20000	0.75	6.610137087	5.2	62.53809652	5103.363338	0.5	44.3270318	Rp	240,826.98
23	MD-90-30	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2525-D5	2	111.2	0	0	25000	0.75	7.564430089	5.2	62.53809652	5574.43371	0.35	33.8930738	Rp	184,139.71
24	MD-90-30ER	64410	142000	2 Turbofan Engines	IAE International Aero Engines V2528-D5	2	124.5	0	0	28000	0.75	8.472161699	5.2	62.53809652	5574.43371	0.35	33.8930738	Rp	184,139.71
25	B707-120B	86300	190000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	8.12982522	5.2	62.53809652	7468.927638	0.51	66.17143998	Rp	359,506.78
26	B707-320	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	7.463871452	5.2	62.53809652	8135.332537	0.51	72.07549662	Rp	391,583.28
27	B707-420	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	7.463871452	5.2	62.53809652	8135.332537	0.51	72.07549662	Rp	391,583.28
28	B707-320B	94000	207000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	7.463871452	5.2	62.53809652	8135.332537	0.51	72.07549662	Rp	391,583.28
29	B707-320C	112100	247000	4 Turbofan Engines	Pratt & Whitney JT3D-3B	4	80.1	0	0	18000	0.75	6.258732529	5.2	62.53809652	9701.816781	0.51	85.95386352	Rp	466,983.89
30	B717-200	49898	110000	2 Turbofan Engines	Rolls-Royce BR700-715C1-30	2	95.3	0	0	21430	0.75	8.370059327	5.2	62.53809652	4318.47684	0.37	27.7571247	Rp	150,803.34
31	B720	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3C-7	4	53.4	0	0	12000	0.75	5.883470998	5.2	62.53809652	6880.41422	0.785	93.82669077	Rp	509,756.64
32	B720B	79500	175000	4 Turbofan Engines	Pratt & Whitney JT3D-1	4	75.62	0	0	17000	0.75	8.334917247	5.2	62.53809652	6880.41422	0.52	62.15271235	Rp	337,673.19
33	B727-100	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3	0	0	14500	0.75	6.551556407	5.2	62.53809652	5599.532076	0.565	54.95944549	Rp	298,592.46
34	B727-100C	64700	142500	3 Turbofan Engines	Pratt & Whitney JT8D-9A	3	62.3	0	0	14500	0.75	6.551556407	5.2	62.53809652	5599.532076	0.565	54.95944549	Rp	298,592.46
35	B727-200	73100	161000	3 Turbofan Engines	Pratt & Whitney JT8D-17	3	71.2	0	0	16000	0.75	6.39857653	5.2	62.53809652	6326.519239	0.6	65.9414118	Rp	358,257.04
36	B737-100	44906	99000	2 Turbofan Engines	Pratt & Whitney JT8D-9A	2	62.3	0	0	14500	0.75	6.29293338	5.2	62.53809652	3886.438755	0.565	38.14542286	Rp	207,242.55
37	B737-200	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	6.674314274	5.2	62.53809652	4043.433363	0.6	42.14477099	Rp	228,970.85
38	B737-200-Convertible-Ex	46720	103000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	6.674314274	5.2	62.53809652	4043.433363	0.6	42.14477099	Rp	228,970.85
39	B737-200 Advanced	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	6.424856037	5.2	62.53809652	4200.427972	0.6	43.78112832	Rp	237,861.11
40	B737-200C/-200QC	48534	107000	2 Turbofan Engines	Pratt & Whitney JT8D-17	2	71.2	0	0	16000	0.75	6.424856037	5.2	62.53809652	4200.427972	0.6	43.78112832	Rp	237,861.11
41	B737-300	52889	116000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9	0	0	22000	0.75	8.106750912	5.2	62.53809652	4577.336198	0.39	31.01127173	Rp	168,482.99
42	B737-400	56245	124000	2 Turbofan Engines	CFM Intl. CFM56-3B2	2	97.9	0	0	22000	0.75	7.623041141	5.2	62.53809652	4867.784878	0.39	32.97905006	Rp	179,173.85
43	B737-500	49895	110000	2 Turbofan Engines	CFM Intl. CFM56-3C1	2	104.5	0	0	23500	0.75	9.17910503	5.2	62.53809652	4318.217202	0.33	24.75486605	Rp	134,492.19
44	B737-600	51936	121500	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	8.255505795	5.2	62.53809652	4494.857773	0.36	28.10998492	Rp	152,720.42
45	B737-700/-Winglets/-700C	58604	129200	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	7.31618915	5.2	62.53809652	5071.947107	0.36	31.71899177	Rp	172,328.01
46	B737-800/-800 Winglets	66361	146300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	8.01750481	5.2	62.53809652	5743.285133	0.38	37.91282378	Rp	205,978.85
47	B737-900/-900 Winglets	66814	147300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	7.963145997	5.2	62.53809652	5782.490512	0.38	38.17162803	Rp	207,384.92
48	B737-900ER/-900ER Winglets	71350	157300	2 Turbofan Engines	CFM Intl. CFM56-7B27	2	121.4	0	0	27300	0.75	7.456897501	5.2	62.53809652	6175.06358	0.38	40.76309845	Rp	221,464.28
49	B737-BBJ	60781	134000	2 Turbofan Engines	CFM Intl. CFM56-7B22	2	97.86	0	0	22000	0.75	7.05414437	5.2	62.53809652	5260.357946	0.36	32.8972773	Rp	178,729.59
50	B737-BBJ2	66360	146300	2 Turbofan Engines	CFM Intl. CFM56-7B26	2	117.4	0	0	26400	0.75	7.7533083	5.2	62.53809652	5743.198587	0.38	37.91225246	Rp	205,975.75
51	B737 Max-7	66043	145600	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	8.262676363	5.2	62.53809652	5715.763476	0.342	33.95803196	Rp	184,492.62
52	B737 Max-8/-200-/-BBJ8	69308	152800	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	7.873433587	5.2	62.53809652	5998.336463	0.342	35.63683174	Rp	193,613.48
53	B737 Max-9	74343	163900	2 Turbofan Engines	LEAP-1B28	2	124.5	0	0	28000	0.75	7.340192554	5.2	62.53809652	6434.09603	0.342	38.22573126	Rp	207,678.86
54	B747-100/-100B	265300	585000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	7.052181596	5.2	62.53809652	22960.6779	0.367	146.38377	Rp	795,297.15
55	B747-100SF	255800	584000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	7.314088262	5.2	62.53809652	22138.49003	0.367	141.1419841	Rp	766,818.73
56	B747-100B SR	273500	564000	4 Turbofan Engines	Pratt & Whitney JT9D-7F	4	213.5	0	0	48000	0.75	6.840745072	5.2	62.53809652	23670.35584	0.367	150.908259	Rp	819,878.51

57	B747-200B/-200B Combi	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	6.819962515	5.2	62.53809652	24731.7571	0.343	147.3639487	Rp	800,622.42
58	B747-200C	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	6.819962515	5.2	62.53809652	24731.7571	0.343	147.3639487	Rp	800,622.42
59	B747-200F	285764	630000	4 Turbofan Engines	Pratt & Whitney JT9D-7J	4	222.4	0	0	50000	0.75	6.819962515	5.2	62.53809652	24731.7571	0.343	147.3639487	Rp	800,622.42
60	B747-300	255800	564000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	8.075972456	5.2	62.53809652	22138.49003	0.373	143.4494825	Rp	779,355.28
61	B747-300SR	242630	535000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	8.514337692	5.2	62.53809652	20998.67802	0.373	136.063909	Rp	739,229.75
62	B747-300	260320	574000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	7.935747365	5.2	62.53809652	22529.67836	0.373	145.9842427	Rp	793,126.53
63	B747-300 Combi	274380	605000	4 Turbofan Engines	Rolls-Royce RB.211-524D4-19	4	235.76	0	0	53000	0.75	7.529097435	5.2	62.53809652	23746.5164	0.373	153.8689171	Rp	835,963.65
64	B747-SP	204100	450000	4 Turbofan Engines	Pratt & Whitney JT9D-7FW	4	218.4	0	0	49100	0.75	9.376871985	5.2	62.53809652	17664.05714	0.367	112.6156331	Rp	611,836.21
65	B747-400 (CF6-80C2B1 engines)	285764	630000	4 Turbofan Engines	General Electric CF6-80C2B1F	4	254.3	0	0	57160	0.75	7.796581147	5.2	62.53809652	24731.7571	0.314	134.9046061	Rp	732,931.31
66	B747-8	312072	688000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8	0	0	66498	0.75	8.305643363	5.2	62.53809652	27008.61166	0.324	152.0160446	Rp	825,897.07
67	B747-8F	345184	761000	4 Turbofan Engines	General Electric GEnx-2B67B	4	295.8	0	0	66498	0.75	7.508919114	5.2	62.53809652	29874.32581	0.324	168.1455124	Rp	913,527.82
68	B757-200/-200PF	92250	210000	2 Turbofan Engines	Rolls-Royce RB.211-535E4-37	2	189	0	0	42500	0.75	8.978671018	5.2	62.53809652	7983.876878	0.324	44.93668165	Rp	244,139.19
69	B757-300	101610	224000	2 Turbofan Engines	Pratt & Whitney PW2043	2	189.49	0	0	42600	0.75	8.170763716	5.2	62.53809652	8793.948289	0.35	53.46802094	Rp	290,489.61
70	B767-200	123377	272000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5	0	0	48000	0.75	7.582222689	5.2	62.53809652	10677.79705	0.343	63.62355614	Rp	345,664.23
71	B767-200ER	136078	300000	2 Turbofan Engines	Pratt & Whitney JT9D-7R4D	2	213.5	0	0	48000	0.75	6.874527026	5.2	62.53809652	11777.01895	0.343	70.17325979	Rp	381,248.50
72	B767-300	136078	300000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	8.593158783	5.2	62.53809652	11777.01895	0.33	67.51363186	Rp	366,798.85
73	B767-300ER	145150	320000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	8.056078959	5.2	62.53809652	12562.16508	0.33	72.01460681	Rp	391,252.47
74	B767-300ER Freighter	147871	326000	2 Turbofan Engines	Pratt & Whitney PW4060	2	266.89	0	0	60000	0.75	7.907837648	5.2	62.53809652	12797.657	0.33	73.36460161	Rp	398,586.93
75	B767-400ER	158757	350000	2 Turbofan Engines	General Electric CF6-80C2B8F	2	282.46	0	0	63500	0.75	7.795255344	5.2	62.53809652	13739.79774	0.323	77.0947882	Rp	418,852.89
76	B777-200 (GE engines)	208700	460000	2 Turbofan Engines	General Electric GE90-94B	2	416.798	0	0	93700	0.75	8.749971647	5.2	62.53809652	18062.16915	0.324	101.661631	Rp	552,323.56
77	B777-200 (P & W engines/RR engines)	206350	455000	2 Turbofan Engines	Pratt & Whitney PW4077	2	343.4	0	0	77200	0.75	7.291255735	5.2	62.53809652	17858.78584	0.33	102.3783267	Rp	556,217.34
78	B777-300	237680	524000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	9.081964756	5.2	62.53809652	20570.27487	0.324	115.7783252	Rp	629,018.99
79	B777-200LR	223168	492000	2 Turbofan Engines	General Electric GE90-115B	2	513.9	0	0	115540	0.75	10.08997164	5.2	62.53809652	19314.318	0.324	108.7092615	Rp	590,613.05
80	B777-300ER	251290	554000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	8.590080716	5.2	62.53809652	21748.16716	0.324	122.4080079	Rp	665,037.79
81	B777-F	260816	575000	2 Turbofan Engines	General Electric GE90-110B1	2	492.7	0	0	110760	0.75	8.276338043	5.2	62.53809652	22572.60522	0.324	127.0482988	Rp	690,248.31
82	B777-9	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5	0	0	78129	0.75	5.718723568	5.2	62.53809652	23043.58905	0.45	180.1377745	Rp	978,681.30
83	B777-9X/-8X	266258	587000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.5	0	0	78129	0.75	5.718723568	5.2	62.53809652	23043.58905	0.45	180.1377745	Rp	978,681.30
84	B787-8	172365	380000	2 Turbofan Engines	General Electric GEnx-1B70	2	321.6	0	0	72300	0.75	8.174829764	5.2	62.53809652	14917.51694	0.45	116.6141393	Rp	633,559.94
85	B787-9	192778	425000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6	0	0	78129	0.75	7.898494122	5.2	62.53809652	16684.1823	0.45	130.4246254	Rp	708,591.75
86	B787-10	201848	445000	2 Turbofan Engines	Rolls-Royce Trent 1000-J2	2	347.6	0	0	78129	0.75	7.543576849	5.2	62.53809652	17469.15534	0.45	136.5609653	Rp	741,930.24
87	A300B2-100	127500	281089	2 Turbofan Engines	General Electric CF6-50C	2	226.859	0	0	51000	0.75	7.795599072	5.2	62.53809652	11034.62658	0.394	75.52591933	Rp	410,329.29
88	A300B2-200	130000	286600	2 Turbofan Engines	General Electric CF6-50C2	2	233.53	0	0	52500	0.75	7.870556756	5.2	62.53809652	11250.99181	0.371	72.51149775	Rp	393,952.06
89	A300B4-100	133000	293214	2 Turbofan Engines	General Electric CF6-50C2	2	233.53	0	0	52500	0.75	7.6930254	5.2	62.53809652	11510.63008	0.371	74.18484	Rp	403,043.26
90	A300B4-600	134000	295419	2 Turbofan Engines	Pratt & Whitney PW4158	2	258	0	0	58000	0.75	8.435536309	5.2	62.53809652	11597.17617	0.323	65.07241645	Rp	353,535.83
91	A300C4-600	136000	299828	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3	0	0	60100	0.75	8.612417357	5.2	62.53809652	11770.26835	0.34	69.51962795	Rp	377,697.35
92	A300F4-200	136000	299828	2 Turbofan Engines	General Electric CF6-50C1	2	233.53	0	0	52500	0.75	7.52332631	5.2	62.53809652	11770.26835	0.371	75.85818226	Rp	412,134.46
93	A300F4-600	140000	308646	2 Turbofan Engines	General Electric CF6-80C2A5	2	267.3	0	0	60100	0.75	8.36634829	5.2	62.53809652	12116.45272	0.34	71.56432288	Rp	388,806.09
94	A310-200	118500	261247	2 Turbofan Engines	General Electric CF6-80A2	2	222.411	0	0	50000	0.75	8.223205772	5.2	62.53809652	10255.71176	0.357	63.60279196	Rp	345,551.41
95	A310-300	123000	271168	2 Turbofan Engines	Pratt & Whitney PW4152	2	232.197	0	0	52200	0.75	8.270940479	5.2	62.53809652	10645.16917	0.312	57.69648015	Rp	313,462.66
96	A318-100	57500	125766	2 Turbofan Engines	Pratt & Whitney PW6122	2	97.86	0	0	22000	0.75	7.456659982	5.2	62.53809652	4976.400222	0.36	31.12145974	Rp	169,081.64
97	A319-100	61000	134482	2 Turbofan Engines	CFM Intl. CFM56-5B5	2	97.86	0	0	22000	0.75	7.028818836	5.2	62.53809652	5279.31154	0.32	29.34738619	Rp	159,443.17
98	A319-Neo	62800	138450	2 Turbofan Engines	IAE International Aero Engines V2524-A5	2	104.533	0	0	23500	0.75	7.292857412	5.2	62.53809652	5435.094504	0.36	33.99004647	Rp	184,666.56
99	A320-200	64500	142198	2 Turbofan Engines	CFM Intl. CFM56-5A1	2	111.206	0	0	25000	0.75	7.55387507	5.2	62.53809652	5582.222858	0.33	32.00097926	Rp	173,860.04
100	A320-Neo	66300	146166	2 Turbofan Engines	IAE International Aero Engines V2527-A5	2	117.878	0	0	26500	0.75	7.789720038	5.2	62.53809652	5738.005822	0.36	35.88439619	Rp	194,958.48
101	A321-100	75500	166449	2 Turbofan Engines	FM Intl. CFM56-5B1/P	2	133.447	0	0	30000	0.75	7.743972588	5.2	62.53809652	6534.229857	0.35	39.72872337	Rp	215,844.56
102	A321-200	77800	171520	2 Turbofan Engines	FM Intl. CFM56-5B3/2P	2	142.3	0	0	32000	0.75	8.016040177	5.2	62.53809652	6733.285866	0.36	42.10868814	Rp	228,774.81
103	A321-Neo	79200	174606	2 Turbofan Engines	IAE International Aero Engines V2533-A5	2	146.791	0	0	33000	0.75	8.1204157	5.2	62.53809652	6854.450393	0.37	44.05716214	Rp	239,360.79
104	A330-200	180000	396832	2 Turbofan Engines	General Electric CF6-80E1A2	2	300.255	0	0	67500	0.75	7.30837413	5.2	62.53809652	15578.29635	0.332	89.84630117	Rp	488,131.35
105	A330-200F	182000	401241	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	7.345852972	5.2	62.53809652	15751.38853	0.323	88.38193876	Rp	480,175.52
106	A330-300	187000	412264	2 Turbofan Engines	Pratt & Whitney PW4164	2	284.686	0	0	64000	0.75	6.670031292	5.2	62.53809652	16184.11898	0.323	90.810014	Rp	493,367.16
107	A330-800	186000	410060	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	7.187877639	5.2	62.53809652	16097.57289	0.323	90.32439896	Rp	490,728.83
108	A330-900	191000	421083	2 Turbofan Engines	Pratt & Whitney PW4168A	2	305.148	0	0	68600	0.75	6.999713303	5.2	62.53809652	16530.30335	0.323	92.7524742	Rp	503,920.47
109	A340-200	185000	407855	4 Turbofan Engines	CFM Intl. CFM56-5C2	4	138.785	0	0	31200	0.75	6.573586245	5.2	62.53809652	16011.0268	0.32	89.00436796	Rp	483,557.16
110	A340-300	192000	410060	4 Turbofan Engines	CFM Intl. CFM56-5C4	4	151.2	0	0	34000	0.75	6.902353345	5.2	62.53809652	16616.84944	0.33	95.25872895	Rp	517,536.85
111	A340-500	246000	542337	4 Turbofan Engines	Rolls-Royce Trent 553-61	4	235.756	0	0	53000	0.75	8.397698188	5.2	62.53809652	21290.33834	0.45	166.4321543	Rp	904,219.21
112	A340-600	265000	584225	4 Turbofan Engines	Rolls-Royce Trent 556-61	4	249.1	0	0	56000	0.75	8.236859397	5.2	62.53809652	22934.71407	0.45	179.2866703	Rp	974,057.28
113	A350-900	205000	451948	2 Turbofan Engines	Trent XWB-84	2	373	0	0	84000	0.75	7.985735635	5.2	62.53809652	17741.94862	0.45	138.6934619	Rp	753,516.01
114	A350-1000	233000	513677	2 Turbofan Engines	Trent XWB-97	2	431.5	0	0	97000	0.75	8.113445386	5.2	62.53809652	20165.23916	0.45	157.6369591	Rp	856,435.27
115	A380-800	395000	870826	4 Turbofan engines	Engine Alliance GP7270	4	311.376	0	0	70000	0.75	6.907492849	5.2	62.53809652	34185.70588	0.38	225.6681694	Rp	1,226,046.10

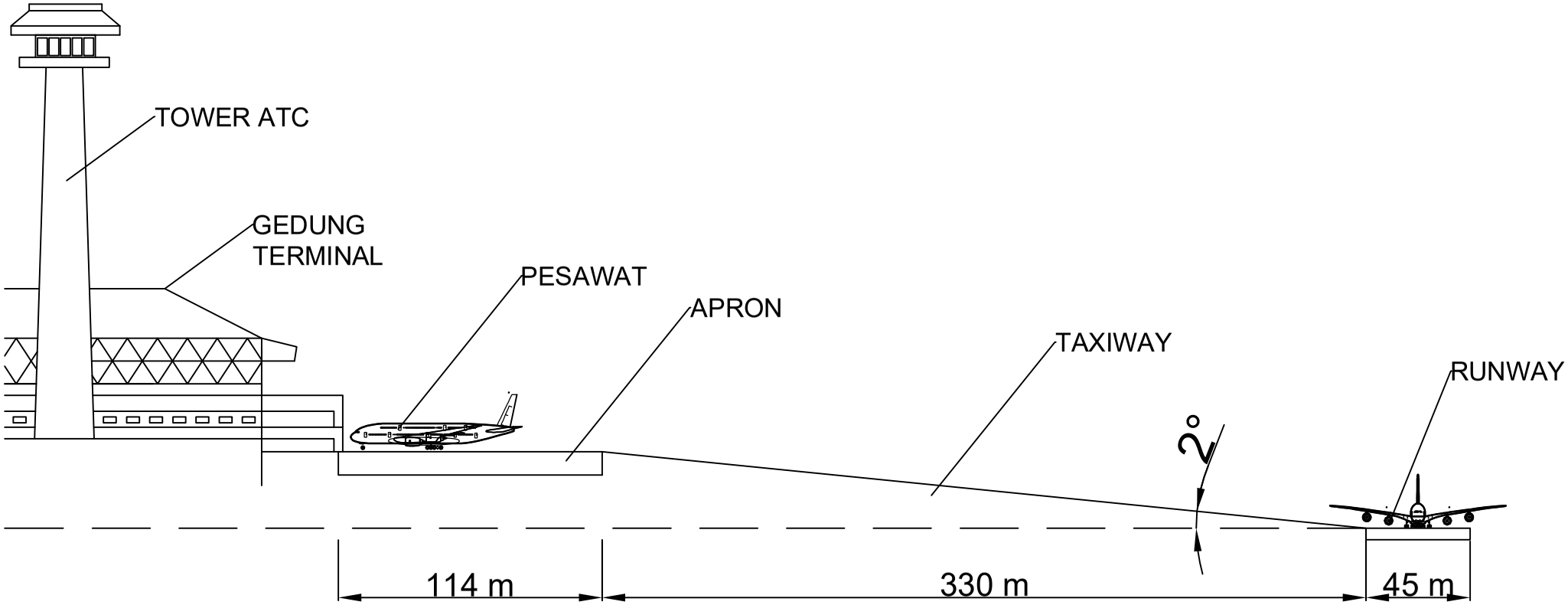
116	BAE146-100A	35153	77499.1	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803	0	0	6700	0.75	7.42902651	5.2	62.53809652	3042.354731	0.411	21.72170092	Rp	118,013.13
117	BAE146-200	36741	81000.04	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041	0	0	6970	0.75	7.394372164	5.2	62.53809652	3179.789923	0.408	22.53724103	Rp	122,443.93
118	BAE146-300	38329	84500.98	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617	0	0	7500	0.75	7.626991709	5.2	62.53809652	3317.225115	0.415	23.91471443	Rp	129,927.68
119	Avro RJ70	37875	83500.08	4 Turbofan engines	Avco Lycoming ALF502R-3	4	29.803	0	0	6700	0.75	6.895117331	5.2	62.53809652	3277.93319	0.411	23.403676	Rp	127,151.23
120	Avro RJ85	38556	85001.43	4 Turbofan engines	Avco Lycoming ALF502R-5	4	31.0041	0	0	6970	0.75	7.046286639	5.2	62.53809652	3336.871078	0.408	23.65057743	Rp	128,492.64
121	Avro RJ100	40143	88500.17	4 Turbofan engines	Avco Lycoming ALF502R-6	4	33.3617	0	0	7500	0.75	7.282339766	5.2	62.53809652	3474.219724	0.415	25.04652825	Rp	136,076.78
122	Bombardier Challenger 300	15308.74	33750	2 Turbofan engines	Honeywell HTF 7000 (AS907)	2	28.9134	0	0	6500	0.75	8.274911167	5.2	62.53809652	1324.911826	0.42	9.66670409	Rp	52,518.82
123	Bombardier CL-600	16329.33	36000	2 Turbofan enginess	Avco Lycoming ALF502L	2	33.3617	0	0	7500	0.75	8.951226022	5.2	62.53809652	1413.239281	0.428	10.50755391	Rp	57,087.12
124	Bombardier CL-601-3A	16329.33	36000	2 Turbofan enginess	General Electric CF34-3A	2	41.0126	0	0	9220	0.75	11.00404052	5.2	62.53809652	1413.239281	0.357	8.764478375	Rp	47,617.06
125	Bombardier CL-601-3R	16329.33	36000	2 Turbofan enginess	General Electric CF34-3A	2	41.0126	0	0	9220	0.75	11.00404052	5.2	62.53809652	1413.239281	0.357	8.764478375	Rp	47,617.06
126	Bombardier CL-604	17236.51	38000	2 Turbofan enginess	General Electric CF34-3B	2	41.0126	0	0	9220	0.75	10.4248805	5.2	62.53809652	1491.752574	0.346	8.966336887	Rp	48,713.75
127	Bombardier CL-605	17236.51	38000	2 Turbofan enginess	General Electric CF34-3B1	2	41.0126	0	0	9220	0.75	10.4248805	5.2	62.53809652	1491.752574	0.346	8.966336887	Rp	48,713.75
128	LEARJET-24D	5388.677	11880	2 Turbojet engines	General Electric CJ610-6	2	13.1	0	0	2950	0.75	10.66913809	5.2	62.53809652	466.3689626	0.98	7.939586293	Rp	43,135.45
129	LEARJET-25D	6032.779	13300	2 Turbojet engines	General Electric CJ610-8A	2	13.1	0	0	2950	0.75	9.530027103	5.2	62.53809652	522.1134009	0.98	8.888594082	Rp	48,291.37
130	LEARJET-31A	7257.478	16000	2 Turbofan engines	Garrett TFE731-2	2	15.6	0	0	3500	0.75	9.398787323	5.2	62.53809652	628.106347	0.504	5.499280549	Rp	29,877.37
131	LEARJET-35A/-36A	6939.963	15300	2 Turbofan engines	Garrett TFE731-2-2B	2	15.6	0	0	3500	0.75	9.828797201	5.2	62.53809652	600.6266943	0.504	5.258687025	Rp	28,570.24
132	LEARJET-40	8708.974	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20AR	2	15.6	0	0	3500	0.75	7.83232277	5.2	62.53809652	753.7276164	0.441	5.774244576	Rp	31,371.24
133	LEARJET-45X	8708.974	19200	2 Turbofan engines	Garret (Honeywell) TFE731-20BR	2	15.6	0	0	3500	0.75	7.83232277	5.2	62.53809652	753.7276164	0.441	5.774244576	Rp	31,371.24
134	LEARJET-55	8164.663	18000	2 Turbofan engines	Garrett TFE731-3A-2B	2	16.236	0	0	3650	0.75	8.712526662	5.2	62.53809652	706.6196403	0.515	6.321717595	Rp	34,345.64
135	Bombardier CRJ-100/-200	20276	44700	2 Turbofan engines	General Electric CF34-3A1	2	41.0126	0	0	9220	0.75	8.862130529	5.2	62.53809652	1754.808538	0.357	10.88278658	Rp	59,125.74
136	Bombardier CRJ-200LR	21319	47000	2 Turbofan engines	General Electric CF34-3B1	2	41.0126	0	0	9220	0.75	8.428564127	5.2	62.53809652	1845.07611	0.346	11.09002543	Rp	60,251.66
137	Bombardier CRJ700	30390	67000	2 Turbofan engines	General Electric CF34-8C1	2	60.9	0	0	13700	0.75	8.785760718	5.2	62.53809652	2630.1357	0.37	16.90526714	Rp	91,845.64
138	Bombardier CRJ1000	36968	81500	2 Turbofan engines	General Electric CF34-8C5A1	2	64.4992	0	0	14500	0.75	7.644191365	5.2	62.53809652	3199.435886	0.39	21.67605161	Rp	117,765.12
139	Dornier 328 Jet/-300	14390	31724	2 Turbofan engines	Pratt & Whitney Canada PW306B	2	26.9	0	0	6050	0.75	8.193775953	5.2	62.53809652	1245.398247	0.394	8.524062582	Rp	46,310.89
140	EMB135BJ	18500	40785	2 Turbofan engines	Allison / Rolls-Royce AE3007A1/3	2	32.0272	0	0	7200	0.75	7.584907205	5.2	62.53809652	1601.10268	0.36	10.0129914	Rp	54,400.18
141	ERJ190-100LR	43000	94799	2 Turbofan engines	General Electric CF34-10E5	2	82.3	0	0	18500	0.75	8.384801328	5.2	62.53809652	3721.481905	0.38	24.56640832	Rp	133,468.31
142	F-28 Fellowship	29030	64000	2 Turbofan engines	Rolls-Royce RB.183 Spey Mk.555-15P	2	44.0374	0	0	9900	0.75	6.646265141	5.2	62.53809652	2512.433017	0.75	32.73391219	Rp	177,842.03
143	F-70	36740	81000	2 Turbofan engines	Rolls-Royce Tay 620-15	2	616	0	0	13850	0.75	7.346832277	5.2	62.53809652	3179.703377	0.43	23.75183794	Rp	129,042.78
144	F-100	38780	88000	2 Turbofan engines	Rolls-Royce Tay 650-15	2	672	0	0	15100	0.75	7.588547318	5.2	62.53809652	3356.257402	0.43	25.07066617	Rp	136,207.92
145	Cessna Citation Sovereign	12508	27575	2 Turbofan engines	Pratt & Whitney Canada PW306C	2	25.2926	0	0	5686	0.75	8.859485194	5.2	62.53809652	1082.518504	0.394	7.409240776	Rp	40,254.11
146	Cessna Citation Longitude	15195	33500	2 Turbofan engines	Honeywell HTF7700L	2	33.81	0	0	7600	0.75	9.747705322	5.2	62.53809652	1315.06785	0.41	9.366431793	Rp	50,887.45
147	Cessna Citation CJ1+	4490.564	9900	2 Turbofan engines	Williams / Rolls-Royce FJ44-1AP	2	8.5	0	0	1900	0.75	8.245977911	5.2	62.53809652	388.6408022	0.456	3.078615093	Rp	16,725.99
148	Cessna Citation CJ1	4445.205	9800	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5	0	0	1900	0.75	8.330120543	5.2	62.53809652	384.7151375	0.456	3.047517971	Rp	16,557.04
149	Cessna Citation CJ2+	5227.652	11525	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447	0	0	3000	0.75	11.18417828	5.2	62.53809652	452.432853	0.46	3.615381427	Rp	19,642.22
150	Cessna Citation CJ2	5216.312	11500	2 Turbofan engines	Williams / Rolls-Royce FJ44-2C	2	10.6757	0	0	2400	0.75	8.966793372	5.2	62.53809652	451.4514369	0.46	3.607538951	Rp	19,599.61
151	Cessna Citation CJ3	5783.303	12750	2 Turbofan engines	Williams / Rolls-Royce FJ44-3A	2	13.3447	0	0	3000	0.75	10.10961998	5.2	62.53809652	500.5222452	0.46	3.99966275	Rp	21,730.01
152	Cessna Citation Encore	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	10.2354914	5.2	62.53809652	596.7010296	0.394	4.084088709	Rp	22,188.69
153	Cessna Citation Encore+	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	10.2354914	5.2	62.53809652	596.7010296	0.394	4.084088709	Rp	22,188.69
154	Cessna Citation II/-IISP	6123.497	13500	2 Turbofan engines	Pratt & Whitney Canada JT15D-4	2	11.1	0	0	2500	0.75	7.956645353	5.2	62.53809652	529.9647302	0.562	5.173988284	Rp	28,110.07
155	Cessna Citation I/-ISP	5148.273	11350	2 Turbofan engines	Pratt & Whitney Canada JT15D-1A	2	9.8	0	0	2200	0.75	8.328189145	5.2	62.53809652	445.5629399	0.54	4.179698721	Rp	22,708.14
156	Cessna Citation Jet	4399.846	9700	2 Turbofan engines	Williams / Rolls-Royce FJ44-1A	2	8.5	0	0	1900	0.75	8.415998075	5.2	62.53809652	380.7894728	0.456	3.016420849	Rp	16,388.09
157	Cessna Citation Mustang	3628.739	8000	2 Turbofan engines	Pratt & Whitney Canada PW615F	2	6.0051	0	0	1350	0.75	7.250493078	5.2	62.53809652	314.0531735	0.394	2.149520373	Rp	11,678.26
158	Cessna Citation S/II	6350.293	14000	2 Turbofan engines	Pratt & Whitney Canada JT15D-4B	2	11.1	0	0	2500	0.75	7.672479448	5.2	62.53809652	549.5930536	0.562	5.36561748	Rp	29,151.18
159	Cessna Citation Ultra	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada PW535A	2	16.107	0	0	3621	0.75	10.2354914	5.2	62.53809652	596.7010296	0.394	4.084088709	Rp	22,188.69
160	Cessna Citation V	6894.604	15200	2 Turbofan engines	Pratt & Whitney Canada JT15D-5A	2	12.8998	0	0	2900	0.75	8.197438568	5.2	62.53809652	596.7010296	0.551	5.711504769	Rp	31,030.38
161	Cessna Citation Excel	8482.177	18700	2 Turbofan engines	Pratt & Whitney Canada PW545A	2	16.8321	0	0	3784	0.75	8.694273181	5.2	62.53809652	734.099293	0.394	5.024503873	Rp	27,297.93
162	Cessna Citation III	9071.847	20000	2 Turbofan engines	Garrett TFE731-3-100S	2	16.2	0	0	3650	0.75	7.841273996	5.2	62.53809652	785.1329337	0.511	6.969574307	Rp	37,865.42
163	Cessna Citation VI	9071.847	20000	2 Turbofan engines	Garrett TFE731-3B-100	2	16.2	0	0	3650	0.75	7.841273996	5.2	62.53809652	785.1329337	0.507	6.915017952	Rp	37,569.01
164	Cessna Citation VII	9071.847	20000	2 Turbofan engines	Garrett TFE731-4	2	18.1487	0	0	4080	0.75	8.765040521	5.2	62.53809652	785.1329337	0.517	7.051408839	Rp	38,310.02
165	Cessna Citation XLS	8482.177	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C	2	28.6554	0	0	6442	0.75	14.8014027	5.2	62.53809652	734.099293	0.36	4.590917244	Rp	24,942.27
166	Cessna Citation XLS+	8482.177	18700	2 Turbofan engines	Allison (Rolls-Royce) AE3007C1	2	30.0878	0	0	6764	0.75	15.5424308	5.2	62.53809652	734.099293	0.36	4.590917244	Rp	24,942.27



LAY OUT FASILITAS SISI UDARA

SKALA 1:10000

INSTITUT TEKNOLOGI SEPULUH NOPEMBER FAKULTAS TEKNIK SIPIL, LINGKUNGAN, DAN KEBUMIAN DEPARTEMEN TEKNIK SIPIL	JUDUL TUGAS	DOSEN PEMBIMBING	NAMA MAHASISWA	NAMA GAMBAR	KETERANGAN	NO. GAMBAR	JUMLAH GAMBAR
	TUGAS AKHIR	Ir. Ervina Ahyudanari, ME., Ph.D.	Firman Arifanto NRP. 03111440000105	LAY OUT FASILITAS SISI UDARA		1	2



POTONGAN A-A

SKALA H: 2500 V:1:800

INSTITUT TEKNOLOGI SEPULUH NOPEMBER FAKULTAS TEKNIK SIPIL, LINGKUNGAN, DAN KEBUMIAN DEPARTEMEN TEKNIK SIPIL	JUDUL TUGAS	DOSEN PEMBIMBING	NAMA MAHASISWA	NAMA GAMBAR	KETERANGAN	NO. GAMBAR	JUMLAH GAMBAR
	TUGAS AKHIR	Ir. Ervina Ahyudanari, ME., Ph.D.	Firman Arifanto NRP. 03111440000105	POTONGAN A-A	SKALA H: 1:2500 V: 1:800	2	2

KEMENTERIAN RISET, TEKNOLOGI, DAN PENDIDIKAN TINGGI
INSTITUT TEKNOLOGI SEPULUH NOPEMBER
FAKULTAS TEKNIK SIPIL, LINGKUNGAN, DAN KEBUMIAN
DEPARTEMEN TEKNIK SIPIL
Kampus ITS Sukolilo, Surabaya 60111
Telp : 031-5946094, Fax : 031-5947284
http://ce.its.ac.id, email: ce@its.ac.id

SURAT PERJANJIAN MULAI MENGERJAKAN TUGAS AKHIR (SP-MMTA)

Nomor : 042032 /IT2.VI.4.1/PP.05.02.00/2018

Berdasarkan hasil ujian seminar Proposal Tugas Akhir periode April 2018 Semester Genap 2017/2018, dan setelah menyerahkan perbaikan Proposal Tugas Akhirnya, maka mahasiswa yang tercantum di bawah ini :

N a m a	:	***Firman Arifanto***
N R P	:	***03111440000105***
Judul Tugas Akhir	:	***Perancangan Kesesuaian Kelandaian Holding Position dan Exit Taxiway Terhadap Kemungkinan Terjadinya Sliding dan Tingkat Konsumsi Bahan Bakar Pesawat***
Pembimbing Tugas Akhir	:	***Ir. Ervina Ahyudanari, ME. PhD***
Tgl. Ujian Proposal TA	:	***20 April 2018***
Tgl. Penyerahan Revisi Proposal TA	:	***3 Mei 2018***
Nilai	:	***82.33***

dinyatakan dapat memulai mengerjakan Tugas Akhirnya di bawah bimbingan Dosen yang telah ditetapkan.

Proses pembimbingan berlaku maksimal selama satu semester, terhitung mulai tanggal **7 Mei 2018** sampai dengan tanggal **7 November 2018** (buku Tugas Akhir sudah masuk).

Apabila Tugas Akhir tersebut tidak dapat diselesaikan dalam waktu yang telah ditentukan, maka :

a. Bila kemajuan penyusunan Tugas Akhir telah mencapai ≥ 75% akan diberikan perpanjangan waktu satu semester.
b. Bila kemajuan penyusunan Tugas Akhir telah mencapai < 75%, diharuskan membuat Proposal Tugas Akhir dengan judul yang baru dan dipresentasikan di depan Team Dosen Penguji.

Demikian Surat Perjanjian ini dibuat untuk dipergunakan sebagai syarat proses pengerjaan Tugas Akhir.

Surabaya, 15 JUN 2018

Menyetujui :
Mahasiswa,

Firman Arifanto
NRP 03111440000105

Mengesahkan :
Program Studi S1 Teknik Sipil,

Dr. techn. Umboro Lasminto, ST. M.Sc
NIP 197212021998021001

Menyetujui :
Dosen Pembimbing I

Ir. Ervina Ahyudanari, ME. PhD
NIP 196902241995122001

tembusan :
- *Dosen Pembimbing*

PROGRAM STUDI S-1 JURUSAN TEKNIK SIPIL FTSP - ITS

LEMBAR KEGIATAN ASISTENSI TUGAS AKHIR (WAJIB DIISI)

Jurusan Teknik Sipil It.2, Kampus ITS Sukolilo, Surabaya 601111
Telp.031-5946094, Fax.031-5947284

Form AK/TA-04
rev01

NAMA PEMBIMBING	: Ir. Ervina Ahyudanari, ME., Ph.D
NAMA MAHASISWA	: FIRMAN ARIFANTO
NRP	: 03111440000105
JUDUL TUGAS AKHIR	: PERANCANGAN KESESUAIAN KELANDAIAN HOLDING POSITION DAN EXIT
	TAXIWAY TERHADAP KEMUNGKINAN TERJADINYA SLIDING DAN TINGKAT KONSUMSI BAHAN BAKAR PESAWAT
TANGGAL PROPOSAL	:
NO. SP-MMTA	:

NO	TANGGAL	KEGIATAN		PARAF ASISTEN
		REALISASI	RENCANA MINGGU DEPAN	
1	26/5-18	progress perhitungan distribusi	Lanjut perhitungan analisa holding	
2	5/6-18	Analisa holding position dan cek tipe pesawat	Analisa perancangan kemampuan taxiing	
3	7/6-18	progress analisa taxiing	progress perancangan bahan bakar	
4	21/6-18	laporan dan perancangan kebutuhan bahan bakar	Lanjut Laporan	

INSTITUT TEKNOLOGI SEPULUH NOPEMBER
FAKULTAS TEKNIK SIPIL, LINGKUNGAN DAN KEBUMIAN
PROGRAM SARJANA (S1)
DEPARTEMEN TEKNIK SIPIL FTSLK – ITS

BERITA ACARA PENYELENGGARAAN UJIAN
SEMINAR DAN LISAN
TUGAS AKHIR

Pada hari ini **Jum'at** tanggal **13 Juli 2018** jam **08.00 WIB** telah diselenggarakan **UJIAN SEMINAR DAN LISAN TUGAS AKHIR** Program Sarjana (S1) Departemen Teknik Sipil FTSLK-ITS bagi mahasiswa:

NRP	Nama	Judul Tugas Akhir
03111440000105	Firman Arifanto	Perancangan Kesesuaian Kelandaian Holding Position dan Exit Taxiway Terhadap Kemungkinan Terjadinya Sliding dan Tingkat Konsumsi Bahan Bakar Pesawat

Dengan Hasil :

□ Lulus Tanpa Perbaikan	□ Mengulang Ujian Seminar dan Lisan
☑ Lulus Dengan Perbaikan	□ Mengulang Ujian Lisan

Dengan perbaikan/penyempurnaan yang harus dilakukan adalah :

(1). Tabel Hlm 69 no 11 perlu diperbaiki penulisan angka.
(2). Jinglatan tipe pesawat perlu dijelaskan di Bab 2.
(3). Proses perhitungan perlu didiskripsikan.
(4). Kemiringan sebaiknya disajikan dlm %
(5). Skid resistance beda u/ bandara. → cek Sayer.
(6). Cek perhitungan luasan tapak roda.
(7). Cek biaya avtur & turunan.
(8). Tambahkan sketsa gambar perbedaan tinggi.

Tim Penguji (Anggota)	Tanda Tangan
Dr. Catur Arif Prastyanto, ST. M.Eng	.....
Cahya Buana, ST. MT	.....
Anak Agung Gde Kartika, ST. MSc	.....

Surabaya, 13 Juli 2018
Dosen Pembimbing I
(Ketua)

Ir. Ervina Ahyudanari, ME, PhD

Dosen Pembimbing 2
(Sekretaris)

BIODATA PENULIS

Penulis memiliki nama lengkap Firman Arifanto. Penulis dilahirkan di Mataram, 3 April 1994, merupakan anak kedua dari 3 bersaudara. Penulis berasal dari Kota Mataram, Lombok, Nusa Tenggara Barat. Penulis menempuh jenjang pendidikan formal di TK Pertiwi Praya, SDN 4 Praya, SMP Negeri 1 Praya dan SMA Negeri 1 Mataram hingga akhirnya diterima sebagai mahasiswa di Institut Teknologi Sepuluh Nopember dan melakukan studi di Departemen Teknik Sipil Fakultas Teknik Sipil, Lingkungan dan Kebumian dengan NRP 03111440000105 pada tahun 2014 melalui jalur SBMPTN. Untuk menyelesaikan Pendidikan Sarjana, penulis mengambil pendalaman di bidang Transportasi khususnya Perencanaan Bandar Udara. Selama perkuliahan, penulis pernah aktif dalam beberapa kegiatan seminar yang diselenggarakan oleh kampus. Penulis juga mengikuti berbagai kegiatan kemahasiswaan di tingkat departemen dan fakultas. Penulis aktif sebagai pengurus organisasi yakni sebagai staff Divisi Civil Tradisi Juara HMS-FTSLK ITS Periode 2015-2016 pada tahun kedua dan selanjutnya pada tahun ketiga sebagai wakil Kabiro Media dan Database Divisi Civil Tradisi Juara HMS-FTSLK ITS Periode 2016-2017. Apabila pembaca ingin berkorespondensi dan berdiskusi dengan penulis, dapat menghubungi melalui email: firman.aifanto@gmail.com.